SGW-38815
Revision 0

Water-Level Monitoring Plan for the Hanford Site Soil and Groundwater Remediation Project

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Project Hanford Management Contractor for the
U.S. Department of Energy under Contract DE-AC06-08RL14788

CH2MHILL
Plateau Remediation Company

P.O. Box 1600
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J. D. Aardal 02/18/2009
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EXECUTIVE SUMMARY

This document presents the water-level monitoring plan for the Soil and Groundwater Remediation Project at the Hanford Site. Water-level monitoring of the groundwater system beneath the Hanford Site is performed to fulfill the requirements of various state and Federal regulations, orders, and agreements. The primary objective of this monitoring is to determine groundwater flow rates and directions. To meet this and other objectives, water levels are measured annually in monitoring wells completed within the supra basalt aquifer system, the upper basalt-confined aquifer system, and in the lower basalt-confined aquifers for surveillance monitoring. At regulated waste units, water levels are taken monthly, quarterly, semi-annually, or annually, depending on the hydrogeologic conditions and regulatory status of a given site.

The techniques used to collect water-level data are described in this document, as well as the factors that affect the quality of the data and the strategies employed by the project to minimize error in the measurement and interpretation of water levels. Well networks are presented for monitoring the supra basalt aquifer system, the upper basalt-confined aquifer system, and the lower basalt-confined aquifers, all at a regional scale ("surveillance" monitoring), as well as the local-scale well networks for each of the regulated waste units studied by this project ("regulated unit" monitoring). The criteria used to select wells for water table monitoring are discussed. A listing of all of the wells used for water-level monitoring is also provided for fiscal year 2008.

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ACKNOWLEDGMENTS

Thanks are extended to Duane Horton for technical peer review. Additional technical reviews were performed by Stuart Luttrell and Doug Hildebrand, and are much appreciated. Thanks are also extended to Michelle Riffe for text processing, Chris Davis for administrative support, and Chris Newbill for assisting with the figures.

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LIST OF TERMS

CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
DOE	U.S. Department of Energy
DWS	Drinking Water Standard
ERDF	Environmental Restoration Disposal Facility
HEIS	Hanford Environmental Information System
FY	fiscal year
GIS	Geographic Information System
NGVD29	National Geodetic Vertical Datum of 1929
NAVD88	North American Vertical Datum of 1988
NRDWL/SWL	Nonradioactive Dangerous Waste Landfill/Solid Waste Landfill
RCRA	*Resource Conservation and Recovery Act of 1976*
S&GRP	Soil & Groundwater Remediation Project
SALDS	State-Approved Land Disposal Site
TEDF	Treated Effluent Disposal Facility
WAC	*Washington Administrative Code*

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METRIC CONVERSION CHART

Into Metric Units			Out of Metric Units		
If You Know	*Multiply By*	*To Get*	*If You Know*	*Multiply By*	*To Get*
Length			**Length**		
inches	25.4	millimeters	millimeters	0.039	inches
inches	2.54	centimeters	centimeters	0.394	inches
feet	0.305	meters	meters	3.281	feet
yards	0.914	meters	meters	1.094	yards
miles	1.609	kilometers	kilometers	0.621	miles
Area			**Area**		
sq. inches	6.452	sq. centimeters	sq. centimeters	0.155	sq. inches
sq. feet	0.093	sq. meters	sq. meters	10.76	sq. feet
sq. yards	0.836	sq. meters	sq. meters	1.196	sq. yards
sq. miles	2.6	sq. kilometers	sq. kilometers	0.4	sq. miles
acres	0.405	hectares	hectares	2.47	acres
Mass (weight)			**Mass (weight)**		
ounces	28.35	grams	grams	0.035	ounces
pounds	0.454	kilograms	kilograms	2.205	pounds
ton	0.907	metric ton	metric ton	1.102	ton
Volume			**Volume**		
teaspoons	5	milliliters	milliliters	0.033	fluid ounces
tablespoons	15	milliliters	liters	2.1	pints
fluid ounces	30	milliliters	liters	1.057	quarts
cups	0.24	liters	liters	0.264	gallons
pints	0.47	liters	cubic meters	35.315	cubic feet
quarts	0.95	liters	cubic meters	1.308	cubic yards
gallons	3.8	liters			
cubic feet	0.028	cubic meters			
cubic yards	0.765	cubic meters			
Temperature			**Temperature**		
Fahrenheit	subtract 32, then multiply by 5/9	Celsius	Celsius	multiply by 9/5, then add 32	Fahrenheit
Radioactivity			**Radioactivity**		
picocuries	37	millibecquerels	millibecquerels	0.027	picocuries

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1.0 INTRODUCTION

The U.S. Department of Energy's (DOE) Hanford Site occupies approximately 1,500 km^2 (580 mi^2) of land along the Columbia River in south-central Washington State (Figure 1-1). The site was established in 1943 with the primary mission of producing plutonium for national defense. Production continued through the Cold War era but ceased in the late 1980s. The current mission at Hanford is environmental cleanup and waste management.

The uppermost aquifer beneath the Hanford Site is contaminated with both radionuclides and hazardous chemicals. The areal extent of groundwater contamination above drinking water standards has been estimated at 183 km^2 (71 mi^2) (*Hanford Site Groundwater Monitoring for Fiscal Year 2007* [DOE/RL-2008-01]). The major radionuclide and hazardous chemical plumes in the groundwater at Hanford are shown in Figures 1-2 and 1-3, respectively. Remediation of the groundwater and protection of the Columbia River are major goals of the environmental cleanup mission.

The Soil & Groundwater Remediation Project (S&GRP) routinely collects groundwater samples and measures the depth to water in groundwater wells at Hanford in support of environmental cleanup. The specific objectives of the project are to (1) take actions necessary to prevent degradation of the groundwater, (2) remediate groundwater to restore its highest beneficial use where practicable and to protect the Columbia River, and (3) monitor groundwater to identify emerging problems and guide the remediation process (*Hanford Integrated Groundwater and Vadose Zone Management Plan* [DOE/RL-2007-20]). The specific objectives of groundwater monitoring are to (1) assess the nature and extent of contamination in the groundwater system, (2) identify releases of contaminants from regulated units, (3) evaluate the performance of remedial action systems, and (4) provide information needed for the development of groundwater flow and transport models (DOE/RL-2007-20).

Measurements of depth to water in wells represent some of the most basic monitoring information that can be collected about the aquifers beneath Hanford, and this information supports many of the goals of the groundwater project. Depth-to-water measurements are used to calculate water-level elevations in wells (i.e., observed hydraulic heads), which indicate the amount of water in storage in an aquifer. Further, areal differences in hydraulic heads (i.e., hydraulic gradient) indicate the potential for groundwater flow in an aquifer because water flows from areas where the hydraulic head is high toward areas where it is lower. This information is used to determine capture zones in evaluating pump-and-treat remedial systems. In addition, changes in water levels over time provide information on the stressors affecting an aquifer, such as river stage changes or effluent disposal practices. Depth-to-water measurements are also necessary to assess the usability of wells for groundwater sampling since a sufficient amount of water must be present in order for a sampling pump to operate. Water levels are declining over much of the site, so trends in the water-level measurements are used to forecast when a well may become dry or contain too little water to sample.

Figure 1-1. Hanford Site Location Map.

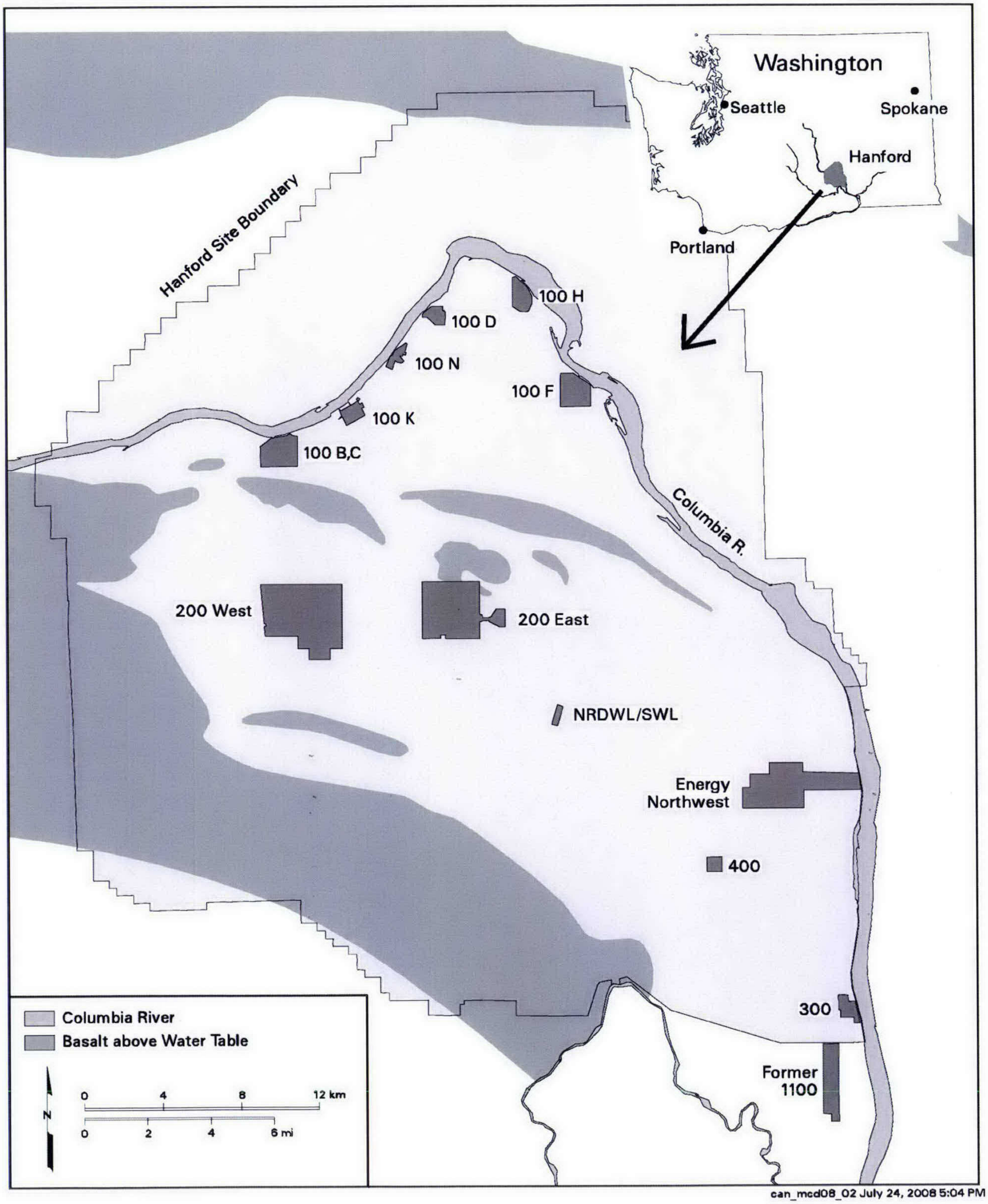
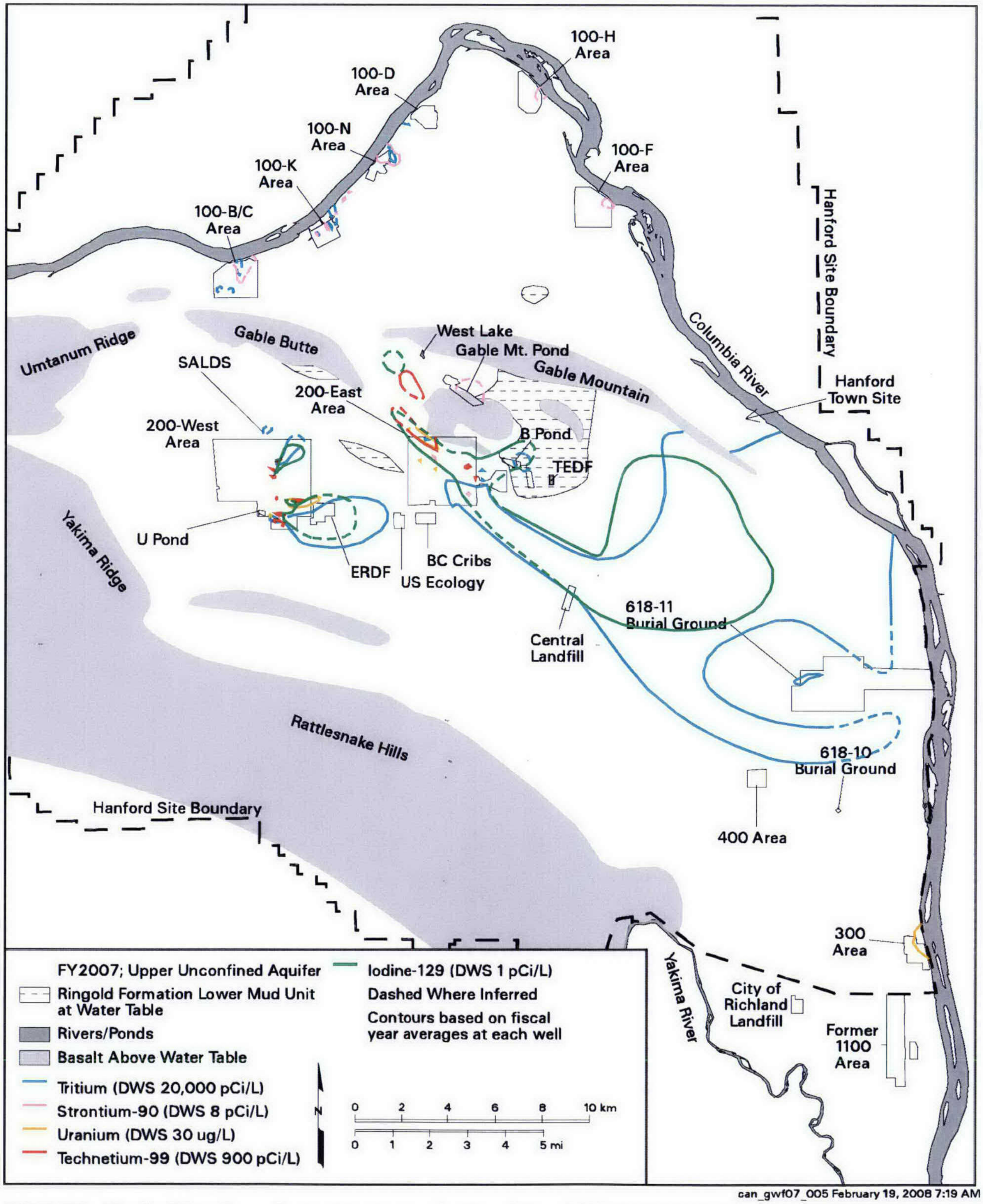
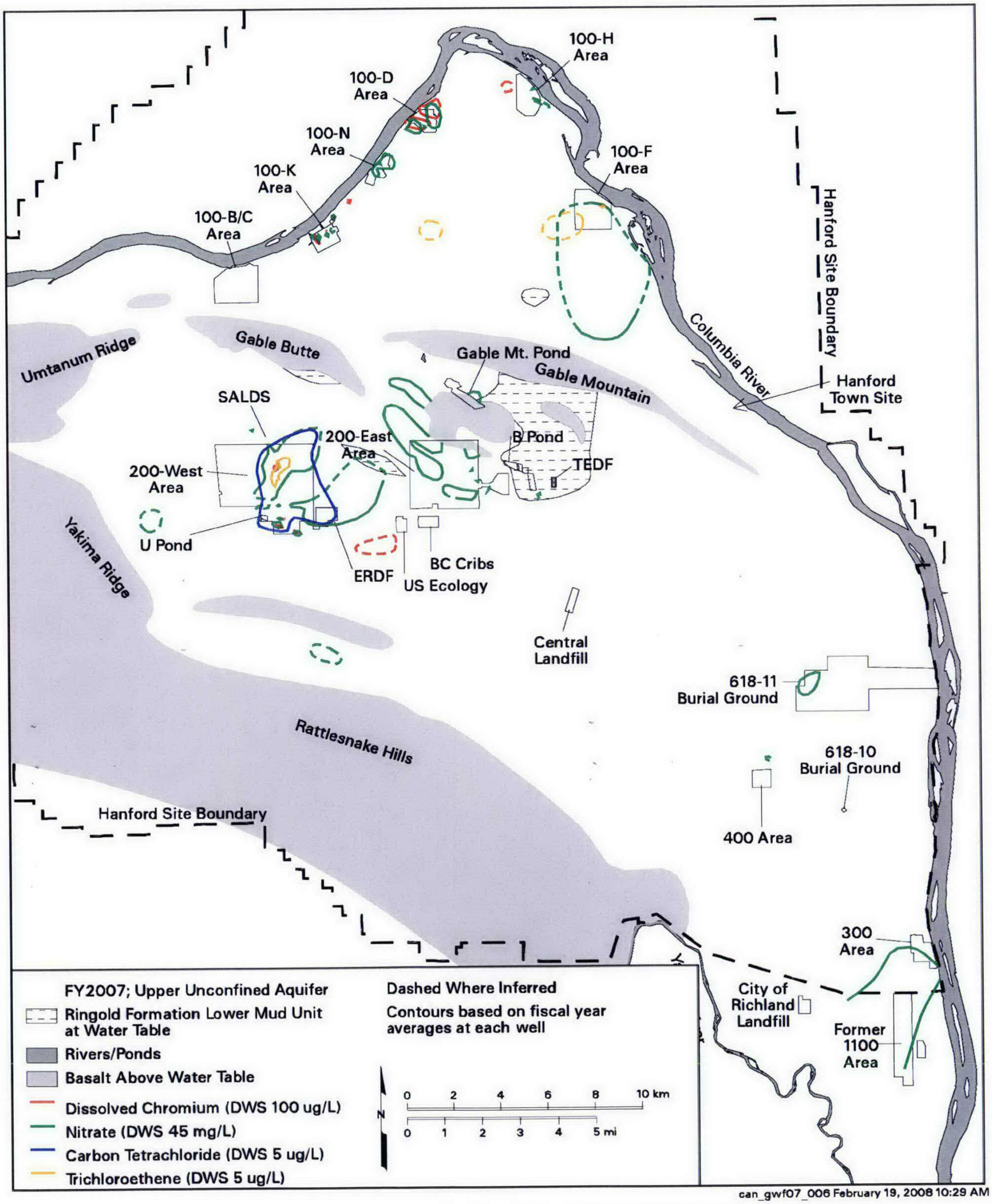


Figure 1-2. Distribution of Major Radionuclides in Groundwater at Concentrations Above Drinking Water Standards, Fiscal Year 2007.



SOURCE: *Hanford Site Groundwater Monitoring for Fiscal Year 2007*, DOE/RL-2008-01.

Figure 1-3. Distribution of Major Hazardous Chemicals in Groundwater at Concentrations Above Drinking Water Standards, Fiscal Year 2007.



SOURCE: *Hanford Site Groundwater Monitoring for Fiscal Year 2007*, DOE/RL-2008-01.

1.1 PURPOSE AND SCOPE

This plan describes the strategy for collecting manual water-level measurements as part of the groundwater project. The focus is on both the regional groundwater system beneath the Hanford Site and localized water-level monitoring conducted by S&GRP at regulated waste units. This plan does not describe the automated water-level monitoring program. The specific objectives of this plan are as follows:

- Provide users of water-level information with a detailed description of the manual water-level monitoring program
- Identify wells within the water-level monitoring network
- Describe the criteria used to select wells for water-level monitoring
- List the frequency and timing of water-level measurements and the considerations used to make these determinations
- Describe the methods and associated quality assurance requirements used to collect water-level data
- Describe how water-level data are managed, analyzed, and reported.

This plan is a revision of the previous plan, *Water-Level Monitoring Plan for the Hanford Groundwater Monitoring Project* (PNNL-13021). There are two major differences between this plan and the previous plan. First, PNNL-13021 listed the hydrogeologic unit(s) monitored by each well, but the current plan only lists this information for the upper basalt-confined aquifer system and the lower basalt-confined aquifers. Second, water-level measurements off the Hanford Site north and east of the Columbia River are no longer collected. These measurements were originally used to assess the potential for contaminants to migrate from Hanford to offsite areas across the Columbia River. Analysis of this data has indicated that the Columbia River represents a regional discharge area for the adjacent unconfined aquifers, so it is very unlikely that transport of Hanford contaminants beneath the Columbia River to offsite areas would occur. Further, hydraulic heads are much higher north and east of the Columbia River than beneath Hanford, so if flow beneath the river does occur, it would be from offsite areas onto the Hanford Site (see Section 2.2).

1.2 WATER-LEVEL MONITORING OBJECTIVES AND REQUIREMENTS

The primary reason for collecting water-level data is to determine the direction and rate of groundwater flow in order to interpret observed contaminant plume patterns and to assess the potential for future plume movement. Other objectives of water-level data analysis include the following:

- Identifying recharge and discharge areas

- Determining the interaction between groundwater and surface water bodies
- Determining the interaction between individual aquifers or hydrogeologic units
- Calibrating groundwater flow models
- Assessing the impact of liquid-effluent disposal practices on groundwater flow
- Assessing the impact of groundwater pump-and-treat operations on localized groundwater flow patterns
- Assessing the effect of water-level and flow-direction changes on the suitability of well networks used for groundwater quality sampling.

In addition to these technical objectives, water-level monitoring is performed to either directly or indirectly fulfill the requirements of several state and Federal regulations, orders, and agreements. The *Atomic Energy Act of 1954* calls for DOE to conduct its operations in a manner that protects the health and safety of the public and the environment. This requirement is implemented by DOE O 450.1, *Environmental Protection Program*, which requires the establishment of environmental management systems at DOE sites to ensure compliance with applicable Federal, state, and local regulations. This order requires that environmental monitoring be performed to "detect, characterize, and respond to releases from DOE activities; estimate dispersal patterns in the environment; [and] characterize the pathways of exposure to members of the public," among other objectives. Water-level monitoring at Hanford supports all of these objectives. Water-level monitoring conducted under DOE O 450.1 is referred to herein as "surveillance monitoring."

Water-level monitoring is also conducted by S&GRP at sites regulated by the *Resource Conservation and Recovery Act of 1976* (RCRA) and three Washington State regulations: *Washington Administrative Codes* (WAC) 173-303, "Dangerous Waste Regulations"; WAC 173-216, "State Waste Discharge Permit Program"; and WAC 173-304, "Minimum Functional Standards for Solid Waste Handling." Water-level monitoring conducted at regulated sites is referred to as "regulated-unit monitoring." The RCRA regulations (40 *Code of Federal Regulations* [CFR] 265, Subpart F and WAC 173-303) require that groundwater elevations beneath regulated sites be evaluated at least annually to assess the ability of groundwater monitoring wells to detect contamination in the uppermost aquifer. If contamination is detected, more frequent water-level measurements may be required to determine the rate and extent of contaminant migration. WAC 173-304 also requires that the rate and direction of groundwater flow in the uppermost aquifer be determined at least annually. Facilities currently operating at Hanford that release liquid effluents to the soil column have permits granted under WAC 173-216. Water-level monitoring conducted at these sites is performed to assess the effect of these effluent releases on the groundwater system.

1.3 PLAN ORGANIZATION

Section 2.0 of this plan provides an overview of the Hanford Site geology and briefly describes the hydrogeologic conditions beneath the site, and it provides the framework for the detailed discussion of specific monitoring networks that follow. Section 3.0 discusses the water-level monitoring program itself, including data collection methods, equipment calibration/ standardization, and the water-level monitoring networks in use for surveillance monitoring. Section 4.0 presents data quality issues and requirements, describes how the water-level data are managed and stored, describes the techniques used to analyze the data, and lists reporting requirements. The references cited in this document are listed in Section 5.0. Appendix A provides a list of the wells used for water-level monitoring by the groundwater project during fiscal year 2008 (FY08) and also well location maps. The wells used for water-level monitoring are constantly being revised as existing wells go dry, new wells are drilled, or as monitoring needs change. However, the wells listed in Appendix A essentially represent the planned network for future water-level monitoring.

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2.0 HANFORD SITE HYDROGEOLOGY

This section provides a brief description of the geologic and hydrogeologic setting for the Hanford Site. The geology and hydrology of the Hanford Site have been reported in numerous studies, including the following:

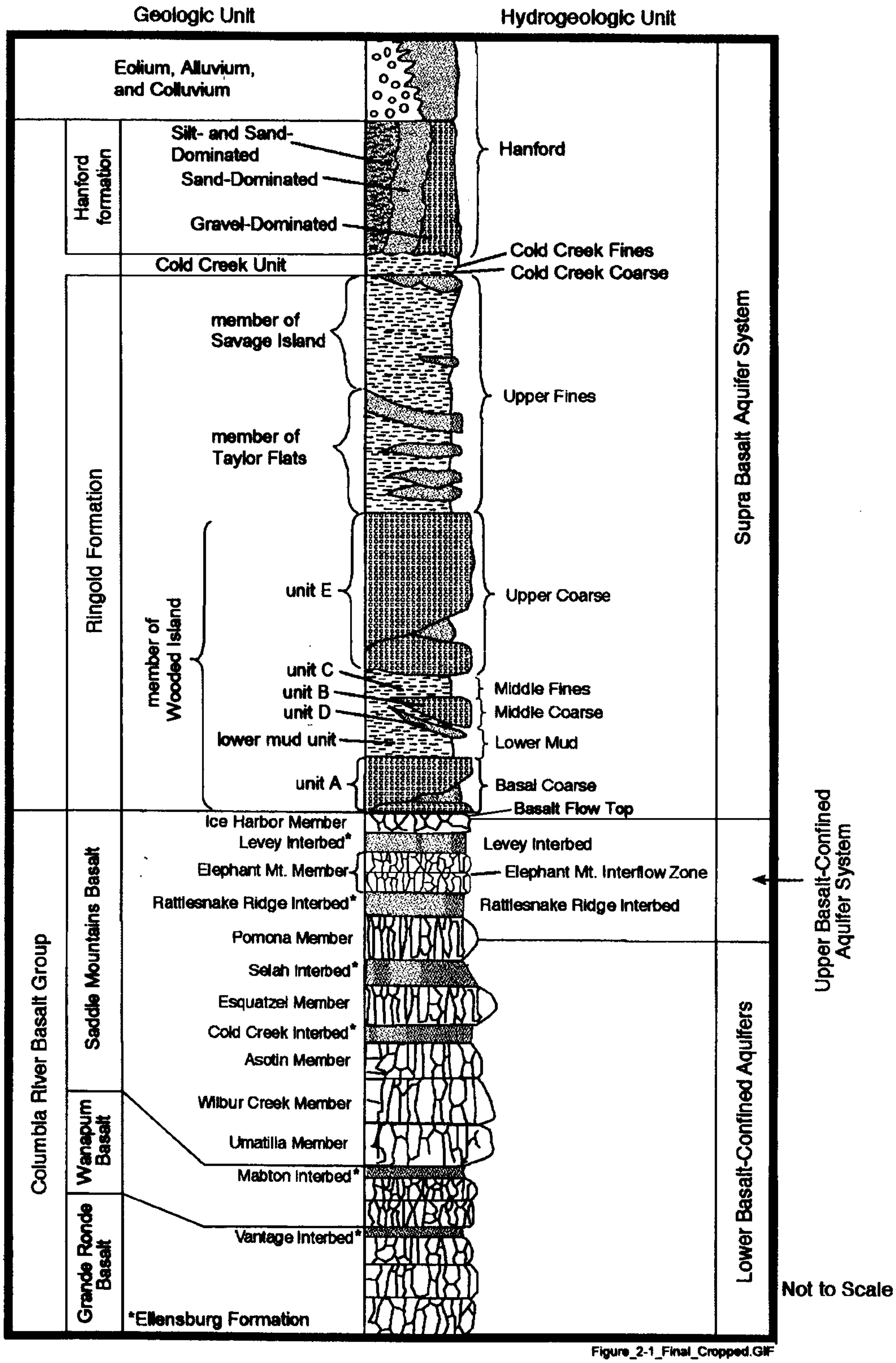
- *Consultation Draft Site Characterization Plan, Reference Repository Location, Hanford Site, Washington* (DOE/RW-0164)
- *Standardized Stratigraphic Nomenclature for Post-Ringold Formation Sediments Within the Central Pasco Basin* (DOE/RL-2002-39)
- *Hydrogeologic Studies Within the Columbia Plateau, Washington: An Integration of Current Knowledge* (RHO-BWI-ST-5)
- *Miocene- to Pliocene-Aged Suprabasalt Sediments of the Hanford Site, South-Central Washington* (BHI-00184).

The stratigraphy of the Hanford Site is shown in Figure 2-1.

2.1 GEOLOGIC SETTING AND STRATIGRAPHY

The Columbia Plateau includes a large portion of eastern Washington and is geologically characterized by a thick sequence of Miocene-age basalt flows known as the Columbia River Basalt Group. As these basalt flows were being erupted, tectonic forces were deforming the land surface into structural and topographic basins and ridges. Between eruptions, sediments were often deposited in the basins, forming interbeds between basalt flows. As the eruption of basalt flows slowed and stopped, a thick sequence of fluvial and lacustrine coarse- and fine-grained sediments were deposited on top of the basalt. Ancient river channels shifted across the basins reworking the coarse-grained channel sediments and depositing fine-grained overbank and lacustrine sediments, forming a complex, interfingered pattern both laterally and vertically. These sediments comprise the Ringold Formation. Subsequent erosion of the Ringold Formation left an irregular surface with a well-developed caliche cap in some places. During the Pliocene, sediments accumulated on this erosional surface forming the Cold Creek unit. Cataclysmic Ice Age floods over the past 1.5 to 2.5 million years further eroded existing sediments and deposited the coarse- and fine-grained sediments informally known as the Hanford formation.

Figure 2-1. Hanford Site Stratigraphy Showing Designated Geologic Units, Hydrogeologic Units, and Aquifer Systems.



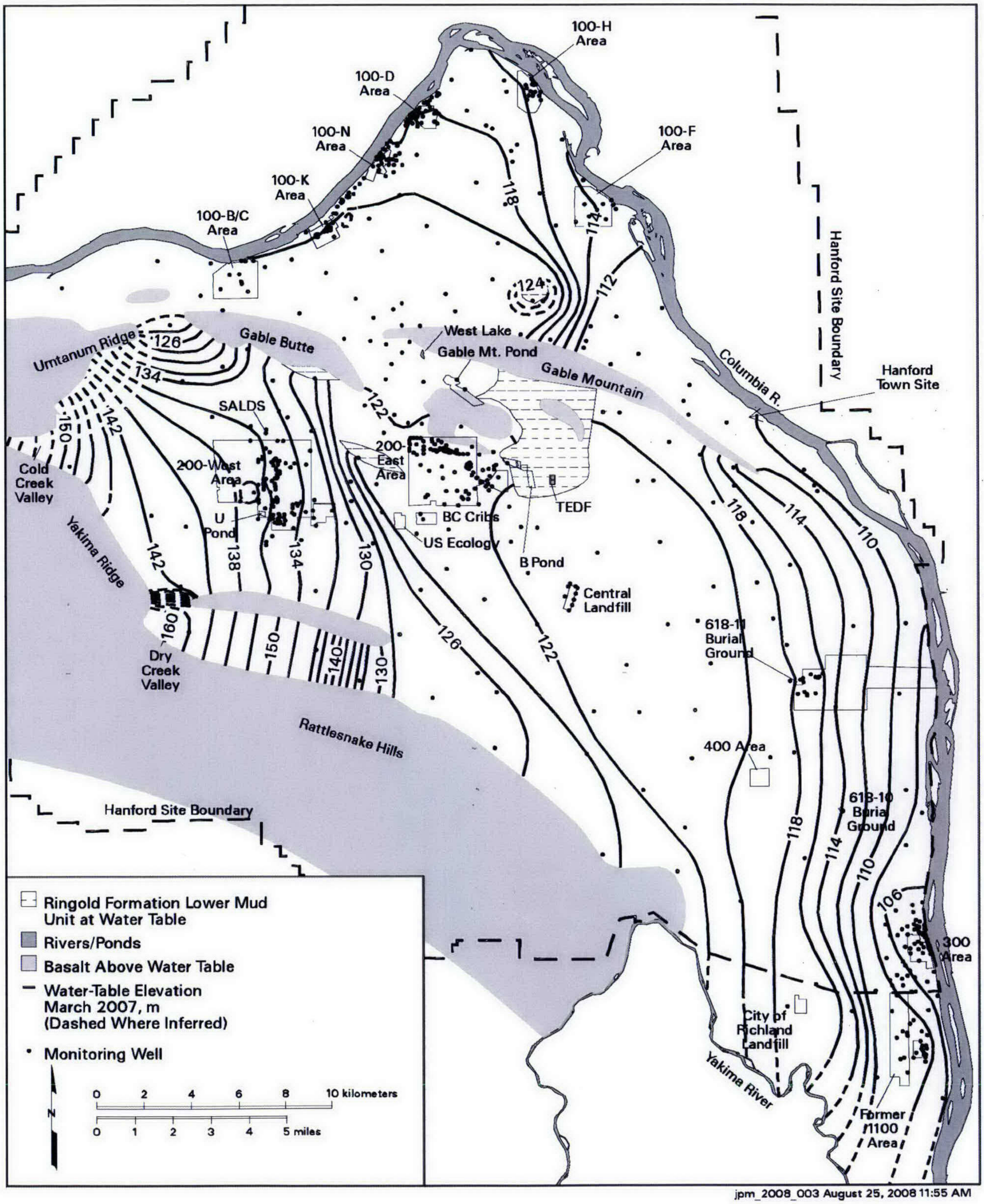
The Hanford Site lies within the Pasco Basin, a topographic and structural depression in the Columbia Plateau surrounded by ridges of basalt. Hanford and Ringold Formation sediments are generally thickest in the center of the basin, thinning laterally against the ridges. The most complete section of the Ringold Formation is in the center of the Pasco Basin, where the basin was subsiding as sediments were deposited. The Ringold Formation is generally more coarse-grained south of Gable Mountain and finer-grained to the north, indicating the ancestral Columbia River channel tended to run between Gable Butte and Gable Mountain during at least part of Ringold time. Ice Age floods eroded channels into the Ringold Formation sediments in the vicinity of the 200 East Area, where the uppermost basalt flow is near the surface, and these channels were subsequently filled with Hanford formation sediments. In the Pasco Basin, the Hanford formation is primarily coarse-grained in the central portion, grading to fine-grained silt and sand near the margins of the basin.

2.2 GROUNDWATER OCCURRENCE

Groundwater beneath the Hanford Site occurs under both unconfined and confined conditions. The supra basalt aquifer system is defined as all groundwater in the unconsolidated to semi-consolidated sediments of the Ringold and Hanford Formations (i.e., sediments above basalt bedrock) and in the porous top of the uppermost basalt flow (Figure 2-1). In some areas, groundwater within the lower Ringold Formation is locally confined by low-permeability mud layers. Groundwater also occurs within the underlying Columbia River Basalt Group in relatively permeable basalt flow contacts and sedimentary interbeds and is confined by the relatively dense inner portions of basalt flows. The upper basalt-confined aquifer system is defined as all groundwater within the Levey and Rattlesnake Ridge interbeds, and within interflow contacts of the Elephant Mountain and Ice Harbor Members of the Saddle Mountains basalt (Figure 2-1). Aquifers in the Columbia River Basalt Group beneath the upper basalt-confined aquifer system are collectively referred to as the lower basalt-confined aquifers.

The water table map for the unconfined aquifer beneath Hanford is shown in Figure 2-2. Groundwater within the unconfined aquifer generally flows from upland areas in the west toward the regional discharge area north and east along the Columbia River. Hydraulic gradients are relatively steep in the west, east, and north regions of the site. Shallow gradients occur southeast of the 100-F Area and in a broad arc extending from west of the 100-B/C Area to the southeast between Gable Butte and Gable Mountain (Gable Gap), and through the 200 East Area into the central portion of the Site. This gradient pattern is caused primarily by changes in the permeability of the sediments that comprise the unconfined aquifer. The steep gradients are due to the presence of the relatively low-permeability sediment of the Ringold Formation at the water table, while the low gradients are associated with areas where the highly permeable sand and gravel of the Hanford formation is present at the water table. Sources of recharge to the supra basalt aquifer system include (1) precipitation and irrigation run-off from elevated areas along the western boundary of the Site, primarily the Cold Creek and Dry Creek Valleys; (2) infiltration of precipitation; (3) upwelling from the underlying upper basalt-confined aquifer system; (4) influent water from the Yakima River along the southern boundary of the site; (5) influent water from the Columbia River west of the 100-B/C Area, and possibly south of the 100-F Area; and (6) disposal of effluent to the soil column.

Figure 2-2. Hanford Site Water Table Map, March 2007.



A potentiometric surface map of a portion of the upper basalt-confined aquifer system is shown in Figure 2-3. Features depicted on the map include (1) a recharge area in the western portion of the site; (2) a small recharge mound to the northeast of B Pond; (3) a hydrogeologic barrier at the mouth of Cold Creek Valley, believed to result from faulting; (4) low hydraulic head in the Umtanum Ridge-Gable Mountain structural area; and (5) the May Junction fault east of the 200 East Area which may act as a barrier to flow. Groundwater generally flows from west to east across the mapped area toward the Columbia River, which represents a regional discharge area for groundwater flow systems. However, the potentiometric contours suggest that groundwater also discharges to the overlying supra basalt aquifer system near the Umtanum Ridge-Gable Mountain structural area. A regional map of this aquifer system was presented in *Preliminary Potentiometric Map and Flow Dynamic Characteristics for the Upper-Basalt Confined Aquifer System* (PNL-8869), which indicated south flow in the northern part of the Site from offsite areas beneath the Columbia River toward the Umtanum Ridge-Gable Mountain structural area. Thus, the Columbia River may not represent a major discharge area for upper basalt-confined groundwater in the northern portion of the Hanford Site.

2.3 HYDROGEOLOGIC UNITS

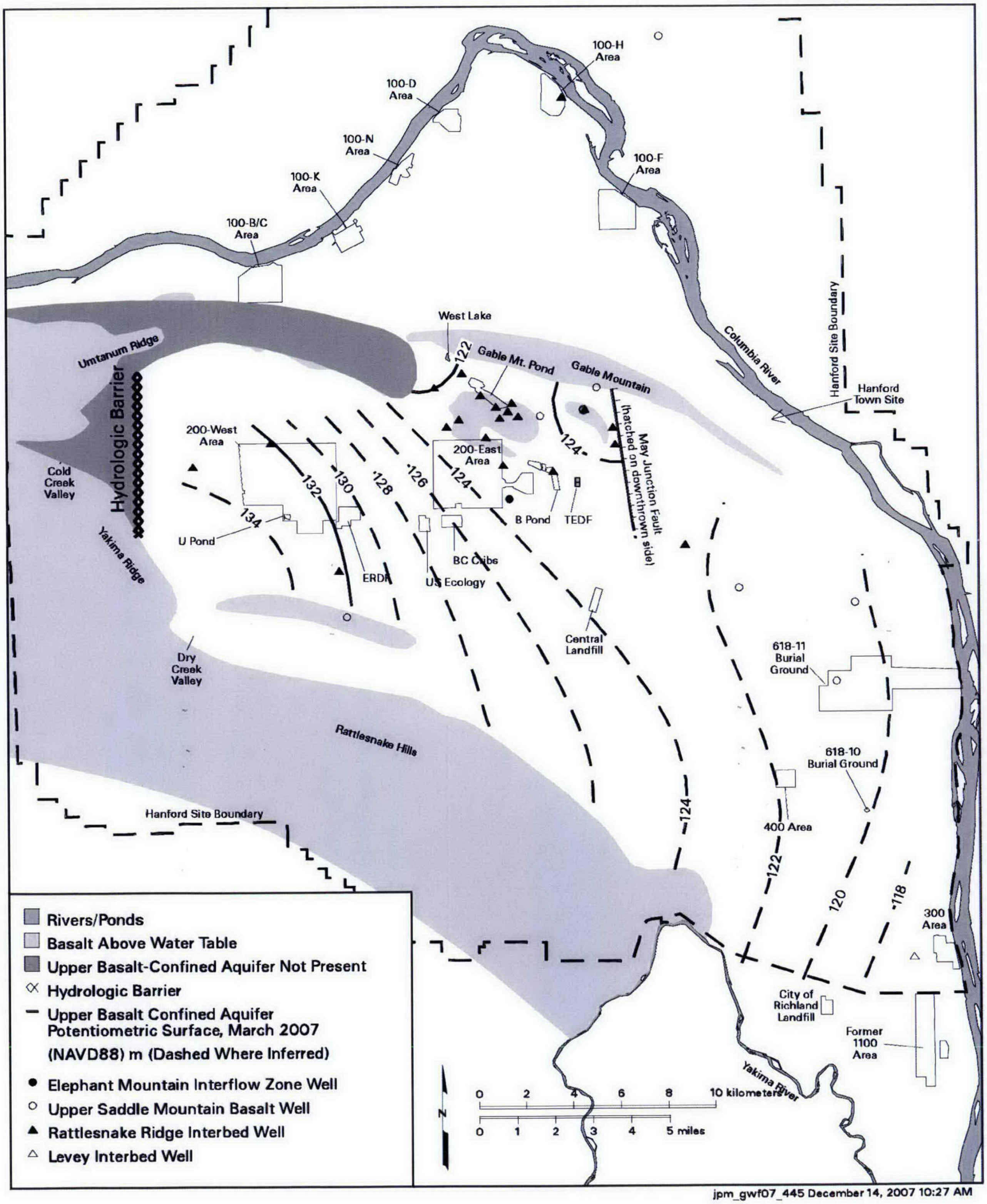
A hydrogeologic unit consists of geologic units having similar hydraulic properties, primarily hydraulic conductivity. This section describes the hydrogeologic units for both the supra basalt aquifer system and the upper basalt-confined aquifer system used for this report.

2.3.1 Supra Basalt Aquifer System

Hydraulic conductivity is strongly related to sediment texture, which is a function of particle-size distribution (i.e., sorting) and cementation. Thus, sedimentary units are grouped into hydrogeologic units based first on particle size as an indicator of hydraulic conductivity. Subsequently, stratigraphic position, color, and presence of distinctive marker horizons are used to help group similar adjacent sediments into units. Although the hydrogeologic units are very similar to the geologic units described in reports such as BHI-00184, there are differences that need to be recognized (Figure 2-1). Geologically, a sand layer may be grouped with an overlying silt layer because of their depositional environment and time of deposition. For a hydrogeologic unit, that same sand would be grouped with an underlying sandy gravel unit instead, based on the assumption that the sand has a hydraulic conductivity more similar to a sandy gravel than a silt. Using this method, ten hydrogeologic units within the supra basalt aquifer system are recognized for this report. Figure 2-1 shows a comparison of the geologic and hydrogeologic units beneath the Hanford Site.

In two new wells (299-E26-77 and 299-E27-79) installed for the Liquid Effluent Retention Facility (LERF) at the northeast corner of the 200 East Area (see Figure 3-7 on page 3-14 for the LERF location), water was encountered in the flow top of the upper most basalt flow. Thus, the basalt flow top, where it contains sufficient porosity and permeability to yield water to monitoring wells, is deemed a hydrogeologic unit. The extent of this unit is not known, because in some areas, the flow top has been eroded and will not be present.

Figure 2-3. Potentiometric Surface Map for the Upper Basalt-Confined Aquifer System, March 2007.



SOURCE: *Hanford Site Groundwater Monitoring for Fiscal Year 2007*, DOE/RL-2008-01.

Where present, the basal coarse hydrogeologic unit lies directly on the basalt. It consists of fluvial sand and gravel and correlates to the geologic Ringold unit A. Overlying the basal coarse is the lower mud unit, which is a relatively extensive mud unit of silt and clay with minor sand and gravel that occurs beneath much of the Hanford Site. The lower mud unit forms a local confining unit in the sedimentary sequence and corresponds to part of the lower mud sequence of BHI-00184. The middle coarse and middle fine hydrogeologic units are more complex, being deposited as the river channel frequently shifted position. This shifting produced a complex pattern of interfingered, mainstream gravel and overbank silt and clay sediments. The middle coarse corresponds to Ringold units B and D and is defined as the coarse-grained unit immediately overlying the lower mud unit. The middle fines hydrogeologic unit is defined as the fined-grained sediments with some interbedded coarse-grained layers overlying the middle coarse. This unit forms a local confining unit within the Ringold Formation.

The upper coarse is a fluvial, coarse-grained sequence corresponding to Ringold unit E and occurs beneath much of the Hanford Site. There are usually no unique characteristics to help distinguish one Ringold Formation gravel or mud unit from another. If geologic units B and D are not present, the middle fines hydrogeologic unit cannot be readily distinguished from the lower mud unit, and consequently these units are typically grouped as the hydrogeologic lower mud unit. Similarly, where mud units are not present, the middle coarse and upper coarse units cannot usually be distinguished and are typically grouped as the upper coarse unit. Overlying the upper coarse are the fined-grained fluvial and lacustrine sediments of the upper fines hydrogeologic unit, which corresponds to the uppermost geologic units of the Ringold Formation, the member of Savage Island and member of Taylor Flat (*The Miocene to Pliocene Ringold Formation and Associated Deposits of the Ancestral Columbia River System, South-Central Washington and North-Central Oregon* [Lindsey 1996]). These sediments have been eroded either in part or entirely from much of the Hanford Site and do not extensively intersect the water table.

The cold creek fines and cold creek coarse hydrogeologic units correspond to different lithofacies of the Cold Creek unit. Both are found only in the western portion of the Hanford Site. The cold creek coarse hydrogeologic unit corresponds to four lithofacies of the Cold Creek unit: the coarse-grained, multilithic; coarse- to fine-grained, calcium carbonate cemented; coarse-grained, rounded, basaltic; and coarse-grained, angular, basaltic lithofacies (DOE/RL-2002-39). The cold creek coarse hydrogeologic unit consists of a paleosoil horizon, stream gravel channels, and colluvium. Calcium carbonate in the paleosoil cemented the sediments as it developed on top of eroded Ringold Formation sediments, creating a caliche zone of low hydraulic conductivity. The caliche appears to intersect the water table in a few places north of the 200 West Area. Where present above the water table, the caliche is thought to impede the movement of water through the vadose zone but does not constitute a barrier to flow. The stream channels have a much higher hydraulic conductivity but are not known to intersect the water table. The cold creek fines hydrogeologic unit corresponds to the fine-grained, laminated to massive lithofacies of the Cold Creek unit (DOE/RL-2002-39). It consists of either eolian silt or alluvial overbank deposits of limited extent and does not intersect the water table.

The hanford hydrogeologic unit is equivalent to the Hanford formation and the overlying holocene deposits. The Hanford formation is generally a high-permeability sand and gravel unit covering much of the Hanford Site. It consists of three facies associations: gravel-dominated, sand-dominated, and interbedded sand- and silt-dominated. In most areas where this unit intersects the water table, the sediments consist of the gravel-dominated or sand-dominated facies associations.

2.3.2 Upper Basalt-Confined Aquifer System

In a sequence of basalt flows, the presence of sedimentary interbeds and the size and communication between pores and fractures in the basalt affect the hydraulic conductivity. Groundwater moves laterally within the Columbia River Basalt Group primarily in two ways: (1) through sedimentary interbeds between basalt flows, and/or (2) within interflow contacts consisting of the vesicular and fractured (porous) flow tops and flow bottoms of the basalt flows themselves. Most basalt flow interiors are dense and solid, have a very low lateral hydraulic conductivity, and generally act as leaky confining layers due to vertical shrinkage fractures. Hydrogeologic units of the upper basalt-confined aquifer system are defined by stratigraphic nomenclature (e.g., Elephant Mountain interflow zone and Rattlesnake Ridge interbed).

Hydrogeologic units for the upper basalt-confined aquifer system are defined to be laterally contiguous, permeable units separated by leaky confining layers. Three primary hydrogeologic units are recognized as important for the lateral transmission of water within this system: the Rattlesnake Ridge interbed, the Levey interbed, and the Elephant Mountain interflow zone (*Summary and Evaluation of Hydraulic Property Data Available for the Hanford Site Upper Basalt Confined Aquifer System* [PNL-10158]). The Rattlesnake Ridge interbed occurs between the Elephant Mountain and Pomona Members of the Saddle Mountains Basalt (Figure 2-1). It is the thickest and most widespread intercalated sedimentary unit within the upper basalt-confined aquifer system. Its thickness ranges from 0 to 33 m (0 to 108.2 ft), and it is primarily composed of tuffaceous siltstone and sandstone. Beneath the Hanford Site, the Rattlesnake Ridge interbed is absent only in the Umtanum Ridge-Gable Mountain structural area. The Levey interbed occurs between the Elephant Mountain Member and the Ice Harbor Member of the Saddle Mountains Basalt (Figure 2-1) and is present only in the southeastern portion of the Hanford Site. The Elephant Mountain interflow zone occurs within the Elephant Mountain Member (between the Elephant Mountain and Ward Gap flows) (Figure 2-1) and is present only in the eastern portion of the site.

3.0 WATER-LEVEL MONITORING PROGRAM

Water levels are measured annually in monitoring wells completed within the supra basalt aquifer system, the upper basalt-confined aquifer system, and in the lower basalt-confined aquifers for surveillance monitoring. At regulated waste units, water levels are taken monthly, quarterly, semi-annually (twice per year), or annually, depending on the hydrogeologic conditions and regulatory status of a given site. This section discusses the data collection process, describes measuring tape calibration/standardization requirements, and shows the distribution of wells used for water table and potentiometric surface mapping at Hanford. The wells used for water-level monitoring during FY 2008 are listed in Appendix A. The appendix also contains maps depicting the locations of the wells.

3.1 DATA COLLECTION

The water level in a well is expressed as an elevation above mean sea level. All monitoring wells have a reference point (e.g., top of casing) whose elevation is obtained by geodetic survey. Field personnel determine the depth to water from this reference point. The elevation of the water level then is computed by subtracting the depth to water from the reference point elevation. In many cases, the measuring point on the well casing (i.e., the actual point on the well casing from which the depth-to-water measurement is made) is not the same as the reference point. When this occurs, an adjustment to the measured depth to water is made so it reflects the depth to water from the reference point.

Procedures consistent with the techniques described in the following are used to manually measure water levels in non-flowing piezometers and wells across the Hanford Site:

- "Standard Methods for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)" (ASTM 1988)
- *Methods of Measuring Water Levels in Deep Wells* (Garber and Koopman 1968)
- *RCRA Ground Water Monitoring Technical Enforcement Guidance Document* (NWWA/EPA 1986)
- *National Handbook of Recommended Methods for Water Data Acquisition* (USGS 1977).

Manual water-level measurements are collected with laminated-steel electric sounding tapes graduated in metric units. Electric sounding tapes are typically between 100 and 150 m (328.1 and 492.1 ft) long and mounted on a hand-cranked reel. Electrodes are contained in a weighted, stainless-steel probe at the end of the tape to (1) serve as a plumb to keep the tape taut in the well, (2) provide the user with some feel for identifying obstructions, and (3) provide insulation of the electrodes to guard against false-positive indications. When the probe electrodes contact water, an electric circuit is closed and an indicator light or buzzer activates to indicate that water has been reached. The tape is held against the measuring point on the well casing at the depth that just causes the electric circuit to close. The depth to water from the measuring point is then read from the tape and recorded on a field record form.

When measuring water levels with tapes, more than one measurement is made until two measurements that agree to within 0.006 m (0.02 ft) are obtained. After the tape is removed from the well, the wetted portion is decontaminated using a towel moistened with deionized or distilled water to guard against cross-contamination of wells. A few wells completed in the upper basalt-confined aquifer system are under flowing artesian conditions, where the potentiometric surface is above the top of the well or piezometer. For these wells, a pressure transducer and data logger are used to measure the equivalent head above the top of the surveyed reference point.

3.2 MEASURING TAPE CALIBRATION/STANDARDIZATION

One measuring tape is periodically calibrated by a standards laboratory, using standards with accuracies traceable to the National Institute of Standards and Technology. Other measuring tapes are standardized every 6 months by comparison to the calibrated tape to determine their suitability for taking water-level measurements. The calibrated tape is used only to check the accuracy of other measuring tapes; it is not used for routine water-level measurements. Standardization is performed at a well with a large depth to water such that much of the length of the measuring tapes is compared to the calibrated tape. Water-level measurements are made with the calibrated tape and with a measuring tape intended to be used for reportable water-level measurements. If the measurements agree to within 0.030 m (0.1 ft), the measuring tape is deemed suitable for water-level monitoring.

3.3 SURVEILLANCE MONITORING

Water-level measurements are made annually in March to provide data (1) for developing a water table map of the unconfined aquifer for the entire Hanford Site, (2) for a potentiometric surface map of the Ringold Formation confined aquifer, (3) for a potentiometric surface map of the upper basalt-confined aquifer system, and (4) to provide information on the vertical flow component within the supra basalt aquifer system. Sections 3.3.1 through 3.3.5 describe why these measurements are made annually in March, as well as describing the monitoring well network used for these measurements. The monitoring well network is revised continually as wells go dry or are decommissioned and new wells are installed. The monitoring well network presented in this section is the network used for FY 2008, and it forms the basis for future water-level monitoring and will be revised as needed.

3.3.1 Measurement Frequency and Timing

Two factors were considered to determine the frequency of surveillance water-level monitoring at Hanford: (1) the rate at which water levels change (i.e., more frequent measurements are required if water levels change rapidly), and (2) the cost associated with taking water-level measurements. The water table map of the Hanford Site is intended to show groundwater flow directions and gradients at a regional scale across the site, representative of the year in which the measurements are taken. However, water levels are subject to seasonal variations, especially in wells adjacent to the Columbia River. Although contaminant plumes respond locally to seasonal variations, their long-term movement is determined by the average (or net) flow rate and direction. Thus, one way of documenting the average flow condition is to measure water levels several times a year and average the results; however, while this approach is effective, it is costly.

A better method is to measure water levels once a year during a month when the groundwater flow system is closest to its annual average condition. The Columbia River represents the largest short-term external stress on water levels in the supra basalt aquifer system. The average and the range of monthly discharge in the Columbia River along the Hanford Site, as well as the average annual discharge for 41 years of record, are shown in Figure 3-1. These data, as well as the standard deviation, are also provided in Table 3-1. In addition to this criterion, it was desired that the month chosen for the annual measurements coincide with a month in which water-level measurements are taken at the regulatory units (generally December, March, June, and September).

Figure 3-1. Mean and Range of Monthly Discharge Compared to Average Annual Discharge in the Columbia River Along the Hanford Site for Fiscal Years 1967 Through 2007.

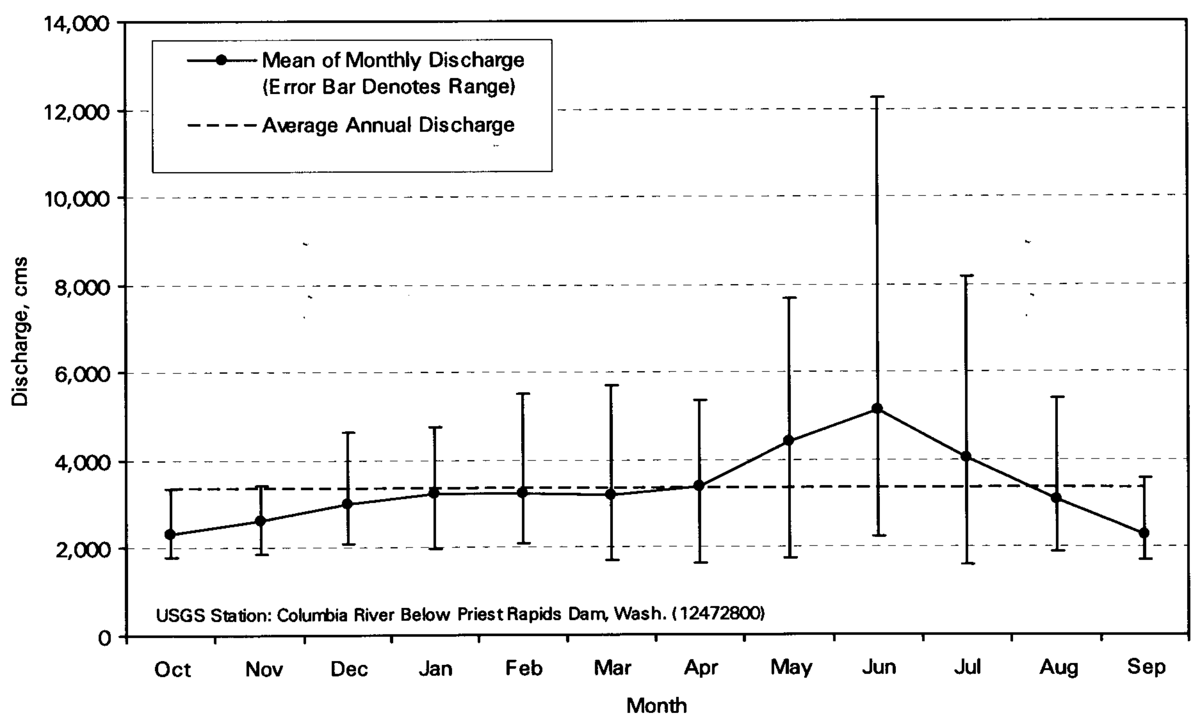


Table 3-1. Monthly Mean, Standard Deviation, and Range of Discharge (Q) in the Columbia River Along the Hanford Site for Fiscal Years 1967 Through 2007.

	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.
Mean Monthly Q (m^3/s)	2,320	2,620	3,020	3,220	3,230	3,200	3,400	4,430	5,130	4,030	3,100	2,300
Monthly Q Standard Dev.	325	363	561	668	746	926	1,000	1,230	2,210	1,450	764	408
Minimum Monthly Q (m^3/s)	1,770	1,850	2,090	1,990	2,090	1,730	1,640	1,750	2,230	1,600	1,890	1,700
Maximum Monthly Q (m^3/s)	3,350	3,430	4,640	4,770	5,520	5,710	5,360	7,690	12,250	8,160	5,410	3,590

NOTE: Annual Columbia River discharge: mean = 3,330 m^3/s, standard deviation = 588.

The month chosen for annual water-level measurements should be one in which the mean monthly discharge in the Columbia River is close to the annual average discharge (3,330 m^3/s) and the standard deviation or range of the mean monthly discharge is small. No month fully meets these criteria, so the month chosen for the annual measurements was a compromise. March represented the best compromise, as it is the only month having a mean monthly river discharge (3,200 m^3/s) near the annual average discharge and also coincides with most regulated unit measurements. The standard deviation (926) is higher than desired but is much lower than the standard deviation for some other months (e.g., 2,210 for June or 1,450 for July). Another advantage to March is that mean discharge in the Columbia River for the previous 3 months is near the annual average (Figure 3-1). This allows water levels in the adjacent aquifer time to recover from the high- and low-flow conditions occurring in the summer and fall. A disadvantage to March is that river flow can be affected in some years by an early spring run-off. However, when this has occurred during the last 41 years of record (FY 1967 through FY 2007), only in 5 years did the peak discharge during a FY occur in March or earlier. Therefore, March was chosen for taking annual surveillance water-level measurements at Hanford.

As was stated previously, water-level measurements are used to determine groundwater flow directions and velocities. Water-level changes resulting from fluctuations of Columbia River stage or barometric pressure can be greater than the water table gradient. To best minimize the effect of these fluctuations, wells in proximity to each other are measured closely in time. When the annual surveillance measurements are taken, wells along the Columbia River are measured first, followed by the remaining wells north of Gable Butte and Gable Mountain. Wells south of Gable Butte and Gable Mountain are then measured, generally from the northwest to the southeast.

3.3.2 Hanford Site Water Table Monitoring Network

The water-level elevation in a well is referred to as the observed hydraulic head. Only those wells that yield observed hydraulic heads representative of the water table are used for water table mapping. The primary factors that influence whether the observed hydraulic head in a well represents the water table elevation are the position of the open interval in relation to the water table, the length of the open interval, and whether there are significant permeability differences in the sediments within the open interval[1].

A relative monitoring zone classification scheme is used to determine the suitability of a given well for water table monitoring. For the supra basalt aquifer system, this classification scheme categorizes wells based on the position of their open interval in relation to both the water table and the Ringold Formation mud units. Table 3-2 describes each relative zone category. It is assumed that wells completed at the top of the unconfined aquifer and that extend to no more than 10.7 m (35 ft) below the water table (zone TU) yield water levels that approximate the water table elevation accurately enough to determine regional groundwater flow rates and directions.

Wells not screened across the water table or that have open intervals deeper than 10.7 m (35 ft) below the water table may also be acceptable for water table mapping. The next most suitable category of well is the upper unconfined category (zone UU), which contains those wells with open intervals extending between 10.7 and 15.2 m (35 and 50 ft) below the water table, whether their open interval occurs across the water table or not. To assess the suitability of such wells for water table monitoring, water levels in wells categorized as upper unconfined were compared to water levels in wells categorized as top of unconfined. There are three locations on the Hanford Site where a well categorized as top of unconfined occurs adjacent to a well categorized as upper unconfined, excluding those wells that have nested piezometer completions not constructed in accordance with the requirements described in WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," because such piezometers may not be hydraulically isolated. Water levels in these wells for March 2008 are provided in Table 3-3. As shown, the water-level elevation in each cluster differs by less than 3 cm (1.2 in.). Therefore, it is assumed that water levels in wells categorized as upper unconfined also provide a good approximation of the water-table elevation, and these wells are used for water table mapping.

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[1] In a strict sense, even in wells with shallow open intervals across the water table with no significant permeability differences in the sediments within the open interval, the observed hydraulic head only equals the water table elevation if the barometric pressure within the well bore equals the barometric pressure at the water table in the aquifer. This is rarely the case because barometric pressure fluctuations are transmitted instantaneously through the well bore but not instantaneously through the vadose zone. However, the difference between the observed hydraulic head and the true water table elevation is generally small and can be ignored for regional water-table mapping.

Table 3-2. Relative Monitoring-Zone Classification Scheme.

Zone	Description
U	(Undifferentiated unconfined) Open to more than 15.2 m (50 ft) of the supra basalt aquifer system, or the open/monitoring interval depth is not documented but is known to be within the supra basalt aquifer system.
TU	(Top of unconfined) Screened across the water table or the top of the open interval is within 1.5 m (5 ft) of the water table, and the bottom of the open interval is no more than 10.7 m (35 ft) below the water table.
UU	(Upper unconfined) The top of the open interval is more than 1.5 m (5 ft) below the water table and the bottom of the open interval is no more than 15.2 m (50 ft) below the water table.
MU	(Middle unconfined) Open interval begins at greater than 15.2 m (50 ft) below the water table and does not extend below the middle coarse hydrogeologic unit or to within 15.2 m (50 ft) of the top of basalt.
LU	(Lower unconfined) Open interval begins at greater than 15.2 m (50 ft) below the water table and below the middle coarse hydrogeologic unit or within 15.2 m (50 ft) of the top of basalt and does not extend more than 3 m (10 ft) below the top of basalt.
CR	(Confined Ringold) Artesian wells for which the open interval does not extend more than 3.0 m (10 ft) below the top of basalt. Typically open to the lower mud and basal coarse hydrogeologic units of the Ringold Formation.
TB	(Top of basalt) Bottom of the open interval is more than 3 m (10 ft) but not more than 9.1 m (30 ft) below the top of basalt.
C	(Undifferentiated basalt-confined) Open interval extends across the dense interior of the Pomona Member of the Saddle Mountains Basalt, or open/monitoring interval depth is not documented but is known to be within the basalt confined aquifers.
UC	(Upper basalt-confined) Open to the upper basalt-confined aquifer system (i.e., does not extend below the dense interior of the Pomona Member of the Saddle Mountains Basalt).
LC	(Lower basalt-confined) Open to the basalt and interflow zones below the dense interior of the Pomona Member of the Saddle Mountains Basalt.

C = undifferentiated basalt-confined
CR = confined Ringold
MU = middle unconfined
LU = lower unconfined
ID = identification
LC = lower basalt-confined
TB = top of basalt
TU = top of unconfined
U = undifferentiated unconfined
UC = upper basalt-confined
UU = upper unconfined

Table 3-3. Comparison of Water-Level Elevations in Top of Unconfined (Zone TU) and Upper Unconfined (Zone UU) Wells in the Same Cluster.

Well Name	Location	Zone[a]	Distance Between Wells (m)	Date	Water-Level Elevation (m)[b]	Elevation Difference (m)
199-N-72	100-N Area	TU		3/4/08	118.660	
199-N-77	100-N Area	UU	10.1	3/4/08	118.684	+0.024
699-S31-E10B	Richland North	TU		3/10/08	107.833	
699-S31-E10C	Richland North	UU	9.2	3/10/08	107.806	-0.027
699-S38-E12A	Richland North	TU		3/10/08	108.592	
699-S38-E12B	Richland North	UU	7.0	3/10/08	108.597	-0.005

[a] See Table 3-2 for a detailed description of the relative monitoring zone classification codes.
[b] North American Vertical Datum of 1988.

Many of the wells outside of the operational areas have large open intervals within the aquifer and are designated as undifferentiated unconfined (zone U). Such wells provide an average (or composite) head across a large, vertical interval of the aquifer. These wells were evaluated individually to determine if they are suitable for water table monitoring. Figure 3-2 presents a histogram of water-level elevation differences between wells categorized as top or upper unconfined and adjacent wells completed deep in the supra basalt aquifer system but not subject to local confining conditions by the Ringold Formation mud units (zones MU for middle unconfined and LU for lower unconfined). All comparisons are for measurements taken on the same day. Again, wells not constructed in accordance with WAC 173-160 and having nested piezometer completions are excluded. For approximately 75% of the comparisons, the water-level elevation in the deep unconfined wells differed from the nearby top or upper unconfined wells by less than 15 cm (5.9 in.), and the difference was less than 30 cm (12 in.) for approximately 90% of the comparisons. The same comparison was made between top or upper unconfined wells and those supra basalt aquifer system wells that are locally confined by the Ringold Formation mud units (zone CR for confined Ringold), as well as those completed at the top of basalt (zone TB) where mud units are present, again excluding nested piezometer completions not constructed in accordance with WAC 173-160. A histogram of these results is shown in Figure 3-3. Although the number of comparisons is small, the water-level difference between the top or upper unconfined wells and adjacent confined Ringold or top of basalt wells suggests an approximate uniform distribution up to about 10 m (33 ft) of head difference, with an additional well pair having a head difference of 27 m (89 ft). It is clear that there are significant head differences between locally confined areas in the supra basalt aquifer system and the water table, so wells screened below the Ringold Formation mud units are not suitable for water table monitoring. Therefore, wells categorized as undifferentiated unconfined (zone U) open within or below the Ringold Formation mud units were deemed unsuitable for water table monitoring and are not part of the water table monitoring network. However, those undifferentiated unconfined wells completed above the mud units, or occurring where the mud units are absent, should provide an approximation of the water table elevation, with an error generally less than about 30 cm (12 in.). These wells are only used for water table mapping at a regional scale in those areas where wells classified as top of unconfined or upper unconfined are not available. Undifferentiated unconfined wells are not used for water table mapping at local scales around the regulated units because the potential error is too large and other wells more appropriate for water table mapping are generally available. For more information regarding the suitability of wells used for water table monitoring, see Section 4.1.2.

Figure 3-2. Histogram of Water-Level Elevation Differences for 17 Comparisons Between Top or Upper Unconfined Wells (Zone TU or UU) and Adjacent Wells Completed Deep in the Supra Basalt Aquifer System but not Subject to Local Confining Conditions (Zones MU and LU).

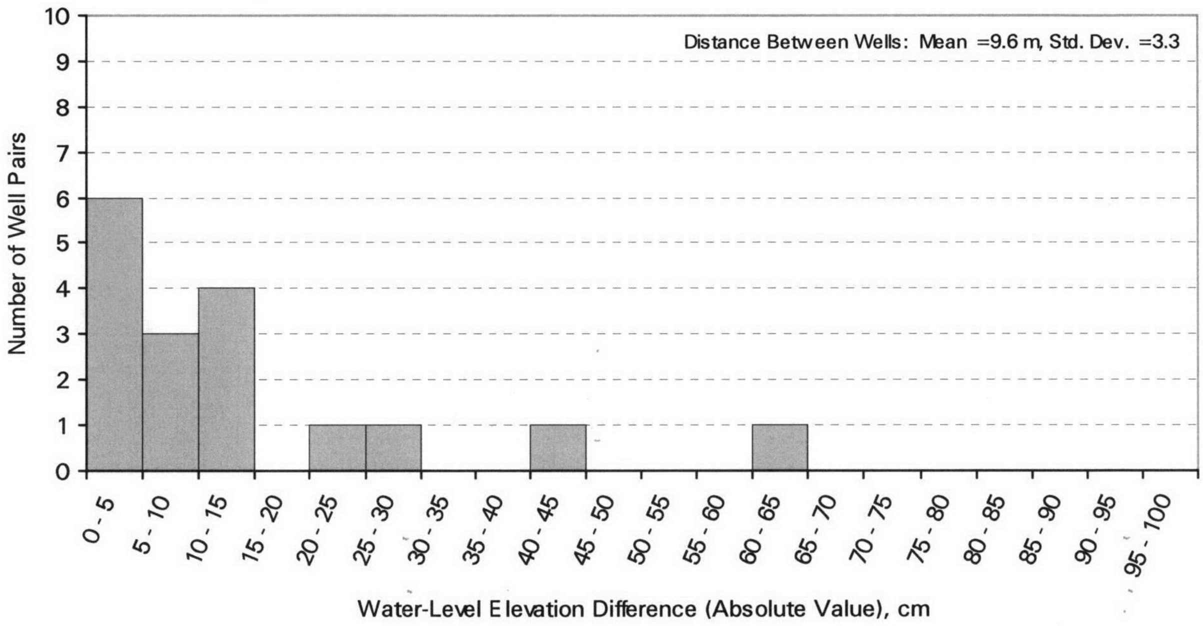
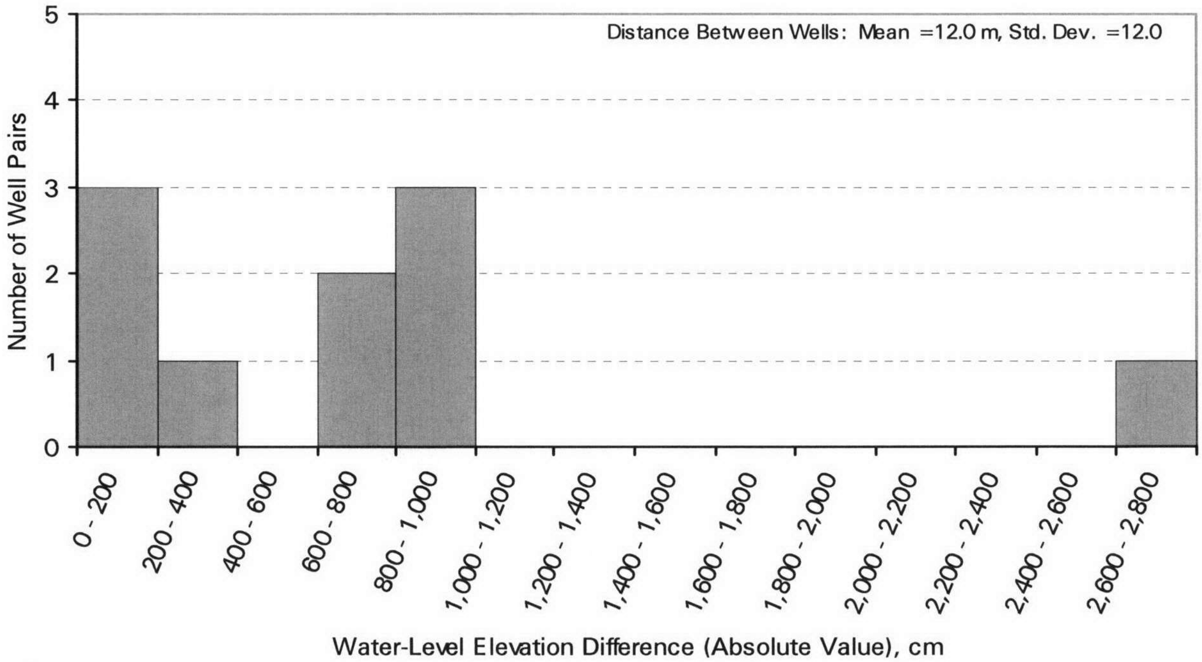


Figure 3-3. Histogram of Water-Level Elevation Differences Between Top or Upper Unconfined Wells (Zone TU or UU) in the Same Cluster with Confined Ringold or Top of Basalt Wells (Zone CR or TB).



The distribution of wells used for water table monitoring is shown in Figure 3-4. Adequate well coverage occurs over much of the Hanford Site, except for south and west of the 200 West Area, south of the 100-F Area, and east of B Pond and the Treated Effluent Disposal Facility (TEDF). The poor coverage in these areas is due entirely to a lack of suitable wells available for water table monitoring. In addition, many of the wells west of the 200 West Area and east of the B Pond/TEDF region are classified as undifferentiated unconfined (zone U). These deficiencies are regional in scale and apply to regions outside of the operational areas, so they do not in any way reflect on the adequacy of the local-scale well networks used for monitoring at specific regulated waste units.

The distribution of wells used for potentiometric surface mapping of the Ringold Formation confined aquifer is shown in Figure 3-5. The distribution of wells in this aquifer is very limited, so only the region south of Gable Butte and Gable Mountain is routinely mapped. The wells used for mapping this aquifer are generally those completed in basal coarse hydrogeologic unit where it is overlain and confined by the lower mud hydrogeologic unit, but some unconfined wells in the basal coarse unit are used along the confined-unconfined boundary to help control the position of the contours.

Figure 3-4. Distribution of Wells Used for Water Table Mapping.

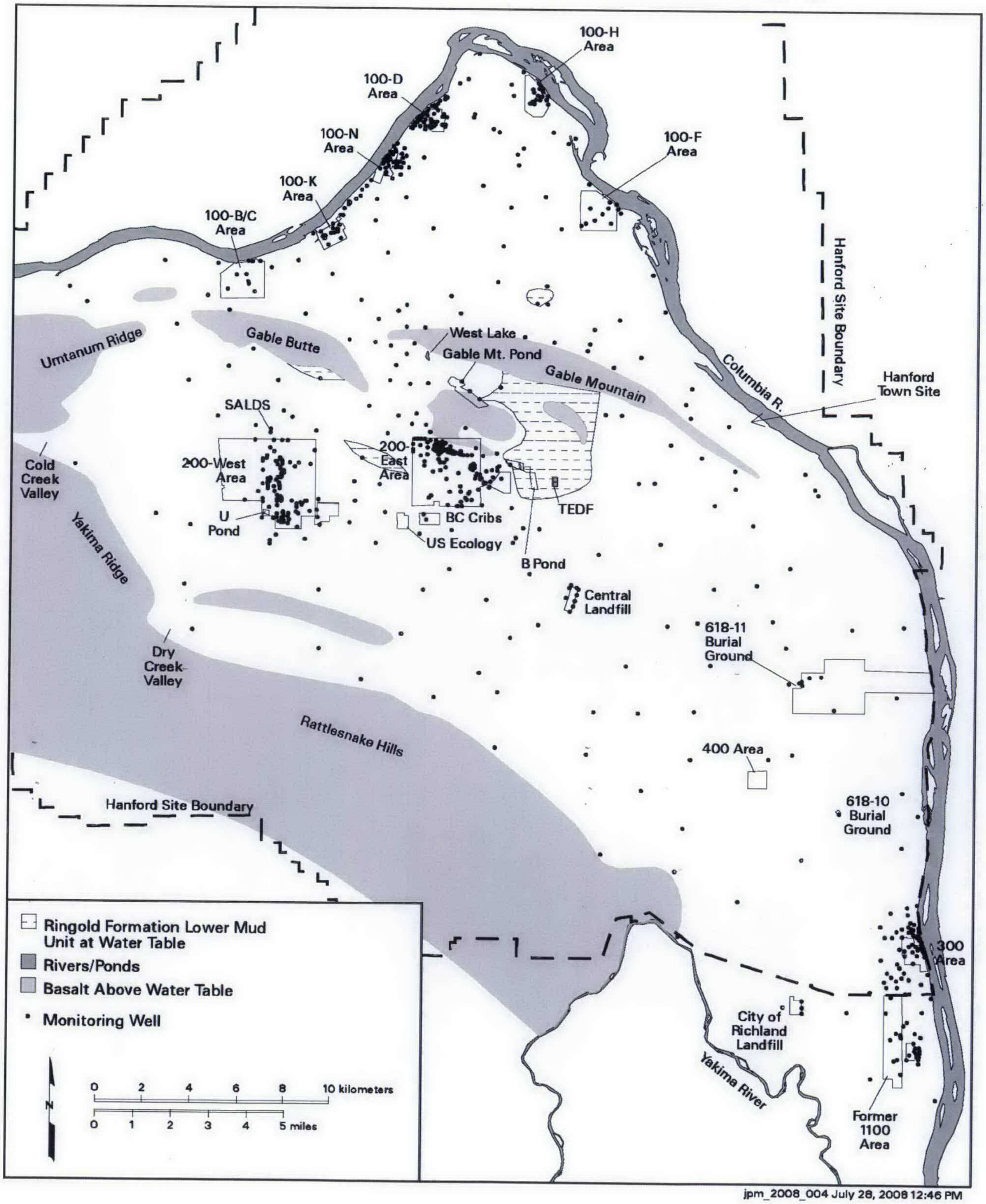
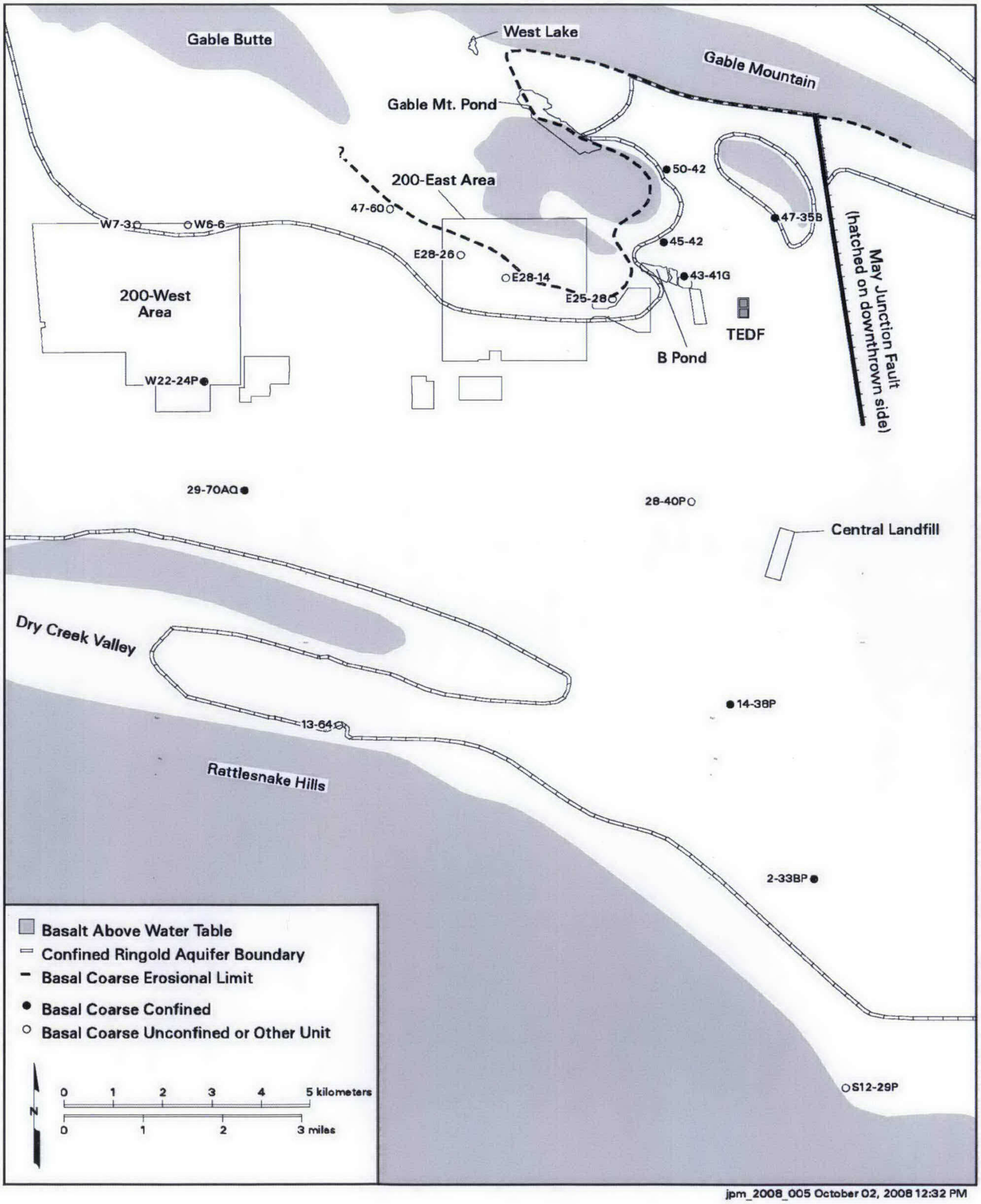


Figure 3-5. Distribution of Wells Used for Mapping the Potentiometric Surface of the Ringold Formation Confined Aquifer.



3.3.3 Upper Basalt-Confined Aquifer System Water-Level Monitoring Network

Water-level measurements are taken annually in wells completed within the upper basalt-confined aquifer system and are used to construct a potentiometric surface map (Figure 2-3). Figure 3-6 presents the well network for this aquifer system. Most of the monitoring wells are completed in the Rattlesnake Ridge interbed and are located between the 200 East Area and Gable Mountain. Well coverage is limited for both the northern and southern portions of the site. Because there are only two wells in the upper basalt-confined aquifer system north of Gable Butte and Gable Mountain, only the southern portion of the site is routinely mapped.

3.3.4 Other Surveillance Measurements

In addition to wells measured for mapping the Ringold Formation confined aquifer, water-level measurements are collected in other wells completed at depth in the supra basalt aquifer system. These measurements provide information on vertical gradients present in this system. These wells are listed in Appendix A and have a relative monitoring zone classification of middle unconfined (zone MU) and lower unconfined (zone LU).

Water-level measurements are also taken annually in wells completed within the lower basalt-confined aquifers beneath the upper basalt-confined aquifer system. These data are collected so that if contamination is found in the lower aquifers, an archive of water-level measurements would be available for use in assessing historical groundwater flow and for possible identification of the contamination source. In addition, water levels in the lower basalt-confined aquifers provide information to assess the effect of stresses external to the Hanford Site on the groundwater system. For example, many irrigation water supply wells in adjacent offsite areas are completed in the lower basalt-confined aquifers, and their operation could influence the flow system beneath Hanford.

3.4 REGULATED UNIT-WATER LEVEL MONITORING

There are 26 RCRA-regulated units on the Hanford Site for which water-level monitoring is performed by the S&GRP. The location of these units is shown in Figure 3-7. Measurements are also collected for various *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) operable units and at the State-Approved Land Disposal Site and the TEDF, which are permitted facilities; these requirements are documented in other site-specific work plans. The frequency at which water-level measurements are scheduled at each site ranges from monthly to annually. Quarterly measurements are generally taken in December, March, June, and September. Semi-annual measurements are generally taken in March and September, although there are some exceptions. Finally, annual measurements are taken in March. In addition to these scheduled measurements, the water level is also measured in each well at the time of sampling. The wells used for water-level monitoring during FY 2008 for each regulated unit are listed in Appendix A. This information is provided for informational purposes only; the specific well networks in use are determined by the project scientist responsible for each facility and are subject to change in accordance with the requirements for those facilities.

Figure 3-6. Distribution of Wells Used for Mapping the Potentiometric Surface of the Upper Basalt-Confined Aquifer System.

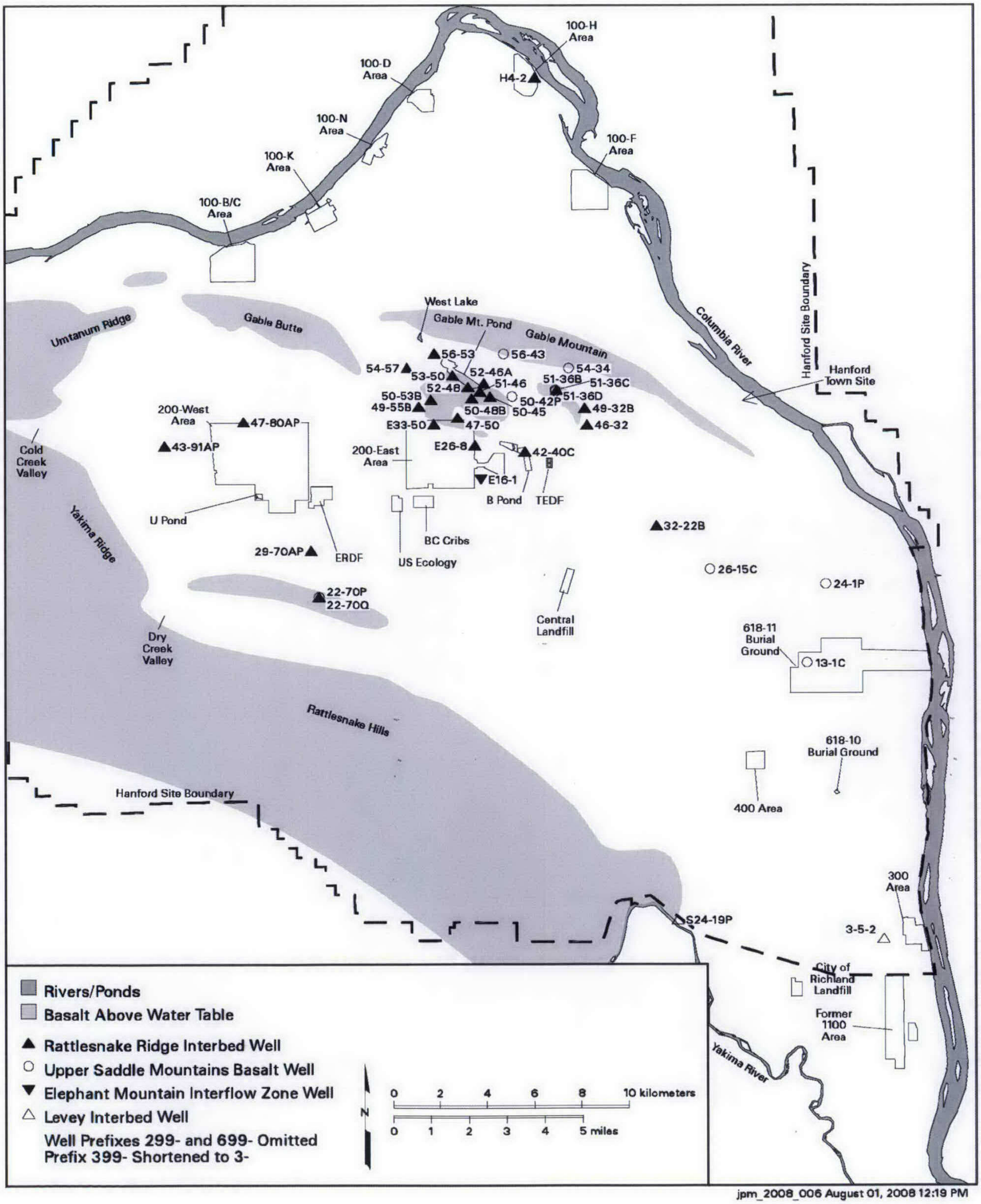
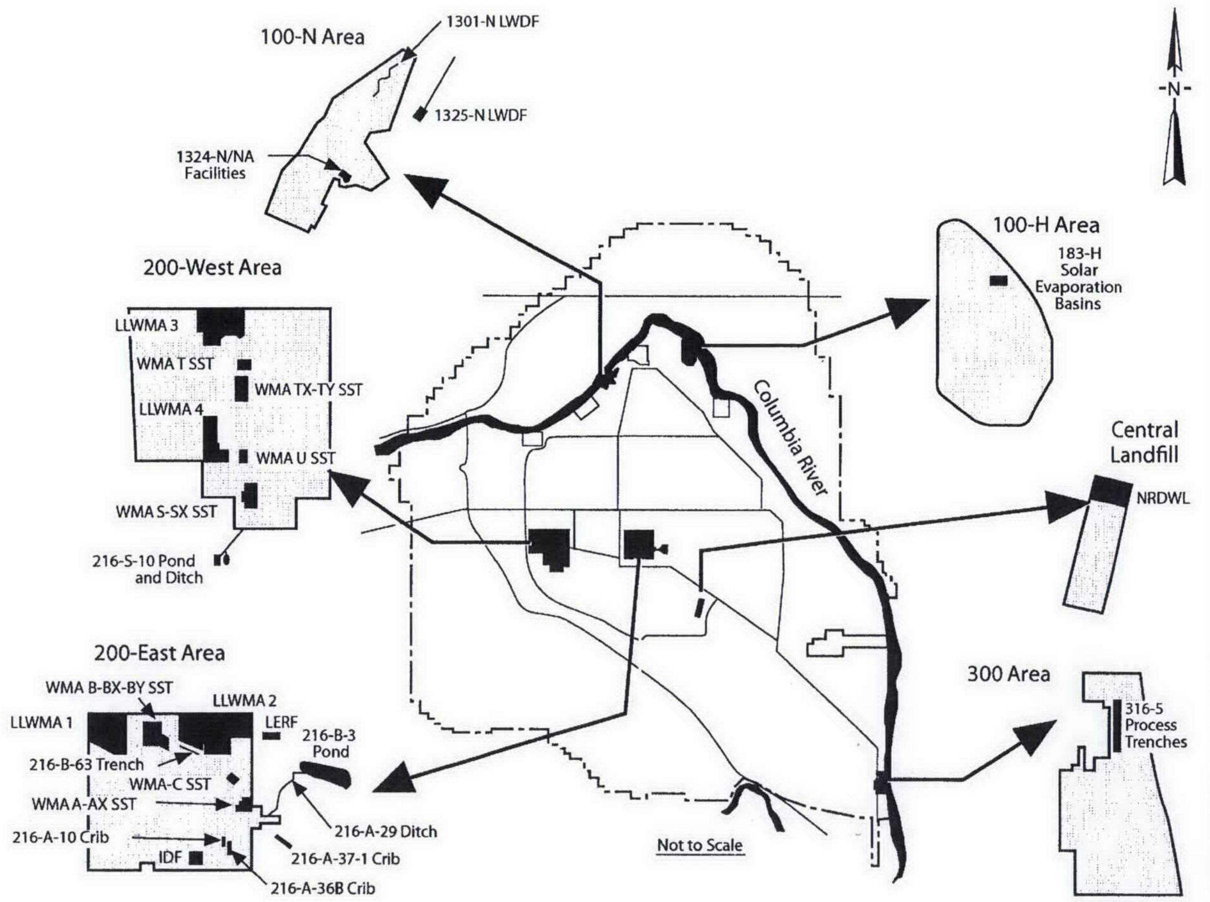


Figure 3-7. RCRA Regulated Units on the Hanford Site Requiring Water-Level Monitoring.



IDF	Integrated Disposal Facility	NRDWL	Nonradioactive Dangerous Waste Landfill
LERF	Liquid Effluent Retention Facility	SST	Single-Shell Tank
LLWMA	Low-Level Waste Management Area	WMA	Waste Management Area
LWDF	Liquid Waste Disposal Facility		

4.0 DATA EVALUATION

This section discusses issues relating to the quality of water-level data collected by the groundwater project and describes how the data are managed, analyzed, and reported.

4.1 DATA QUALITY

To be useful for preparation of water table and potentiometric surface maps, and for determining the direction and velocity of groundwater flow, water-level measurements must be accurate and temporally representative (i.e., the measurements should be taken over as short a time period as possible). This section describes the various sources of error and uncertainty that limit the accuracy and representativeness of water-level data, and it explains the strategy employed by S&GRP to minimize this error.

Error and uncertainty affecting water-level data result from temporal-external stress effects, well design and construction, geodetic survey limitations, instrument limitations, and measurement techniques. Specific sources of error and uncertainty due to temporal-external stress effects include the following:

- Temporal changes in the water table or potentiometric surface over the time period in which water-level measurements are made
- Temporal changes in the water level in a well due to barometric pressure fluctuations that do not affect the actual water table or potentiometric surface, or cause an effect only after a time lag.

Issues associated with well construction and design are listed below:

- Vertical gradients along the length of the screened interval in a well
- Inadequate hydraulic isolation of the monitored interval
- Deviations of the well borehole from vertical.

Geodetic survey issues include those listed below:

- Accuracy of the reference vertical datum in representing elevations above mean sea level
- Accuracy of surveyed reference-point elevations.

Sources of error due to instrument limitations or measurement technique include the following:

- Errors in application of the reference point/measurement point offset correction
- Limits of measuring device precision and accuracy
- Measurement transcription errors.

The degree to which these errors affect the interpretation of water-level data depend on the hydraulic gradient. Where the horizontal gradient is high (>0.001) (e.g., east of the 200 West Area, as shown in Figure 2-2), small measurement errors have little effect on contour map generation or velocity calculations. Where the horizontal gradient is low (<0.001) (e.g., the 200 East Area, as shown in Figure 2-2), small measurement errors (and other types of errors, such as deviation of the well bore from vertical) can have a large effect on determining flow direction and velocity. Similarly, where vertical gradients are large, small measurement errors have little effect on discerning the vertical flow component, but measurement error becomes important where vertical gradients are small. Therefore, the strategy employed for data collection and the data collection method itself (Section 3.1) are designed to minimize the error associated with water-level measurements.

4.1.1 Temporal-External Stress Effects

Fluctuations in the water table or potentiometric surface can be caused by several natural and man-made stresses such as barometric pressure changes, changes in river stage, seasonal variation in natural recharge, irrigation practices, wastewater disposal practices, and groundwater withdrawal/injection. To reduce the effect of seasonal and other long-term water-level changes in representing a water table or potentiometric surface, and in discerning flow-system changes over time, annual surveillance water-level measurements are made within the same one-month period every year (Section 3.3.1). In addition, barometric pressure fluctuations cause water levels in well casings to change instantaneously but may not cause an immediate change in the actual water table outside the well bore, because the overlying sediments restrict the propagation of these pressure fluctuations through the vadose zone to the water table. For this reason, the water-level elevation in a well may not be equal to the actual water table elevation. However, this effect is small compared to the magnitude of the regional hydraulic gradient. Water-level measurements can be corrected for barometric pressure fluctuations (i.e., normalized to a constant barometric pressure), and when such corrections are needed, the multiple regression/ deconvolution method is used ("Identifying and Removing Barometric Pressure Effects in Confined and Unconfined Aquifers" [Rasmussen and Crawford 1997]).

The most significant short-term water-level changes occur in wells influenced by fluctuations in Columbia River stage. Also, monitoring wells in the vicinity of pump-and-treat system extraction and injection wells may experience short-term water-level fluctuations due to changes in system operation. These short-term water-level fluctuations introduce transient effects in representing the water table adjacent to the river or near pump-and-treat systems. Therefore, the water table elevation contours in these areas have a lower confidence in representing a point-in-time water table. Water levels taken within individual operational areas adjacent to the river (i.e., the 100 Areas) or at the pump-and-treat systems are measured as close together in time as is possible to reduce the transient error. To reduce the effect of short-term fluctuations on the regulated unit measurements, water-level measurements are taken within a single day at individual sites, in accordance with U.S. Environmental Protection Agency guidance (NWWA/EPA 1986).

4.1.2 Well Design and Construction

For water table measurements, the degree to which the water level in a well is representative of the water table depends on many factors, including the vertical gradient over the screened interval. This issue was discussed in Section 3.3.2, but is more thoroughly explored here. If the hydraulic potential changes over the length of the screened interval, the water level in that well will be a composite water level not representative of the water table. The best water table measurements are obtained from wells that penetrate only 1 to 2 m (3.3 to 6.6 ft) below the water table. By monitoring such a short interval, a significant vertical gradient is less likely to be encountered across the screened interval. However, such wells usually are impractical for long-term monitoring because the water table may rise above or fall below the screened interval in a relatively short period of time. Many of the monitoring wells installed at Hanford since the mid-1980s have screened intervals ranging in length from 6.1 to 10.7 m (20 to 35 ft). Therefore, it is assumed that wells completed within the upper 10.7 m (35 ft) of the unconfined aquifer are generally suitable for water table monitoring. It was shown in Section 3.3.2 that water levels in wells completed down to 15.2 m (50 ft) beneath the water table provide water-level elevations that are nearly the same as in wells completed down to 10.7 m (35 ft). Therefore, wells completed down to 15.2 m (50 ft) also are assumed to be acceptable for water table measurements.

Wells installed on the Hanford Site prior to the mid-1980s are not compliant with WAC 173-160, particularly those wells outside of the operational areas. Many of these wells have a carbon-steel casing that is perforated over large vertical intervals. Therefore, wells perforated or screened over large intervals are used for water table mapping only where there is no significant vertical gradient or no other nearby more suitable well exists. In some cases, plugs are installed in these wells to limit the effective perforated interval to the uppermost unconfined aquifer. These wells are assumed to provide representative water table measurements. However, the integrity of the installed plugs is questionable, so these wells are evaluated on a case-by-case basis. Also, because these wells do not have bentonite or grout seals, the isolation of the uppermost aquifer is questionable, even with an intact plug.

Deviation of the well borehole from vertical can introduce large errors in water-level measurements, in some cases greater than 1 m (3.3 ft), because the measured depth to water may be larger than the true vertical depth to water. This error results in water-level elevations that are lower than the true values. Borehole path surveys using a gyroscope have been conducted in selected wells in low-gradient areas (i.e., the 200 East Area) to correct for well bore deviation error. In addition, borehole path surveys have been conducted in other areas whenever it is suspected that well bore deviation may be causing significant errors in observed hydraulic heads.

4.1.3 Geodetic Survey Issues

Prior to September 1992, geodetic surveys conducted on the Hanford Site reported reference point elevations using the National Geodetic Vertical Datum of 1929 (NGVD29). In 1993, the Federal Geodetic Control Subcommittee affirmed the North American Vertical Datum of 1988 (NAVD88) as the official vertical datum for surveying and mapping activities performed or financed by the Federal government (*Affirmation of Vertical Datum for Surveying and Mapping Activities* [Federal Register, Doc. 93-14922]). NAVD88 represents a modern and improved vertical datum for North America, and, therefore, is a better representation of the sea-level surface (i.e., the geoid, which is a surface of equal gravitational potential). Since September 1992, reference point elevations for many Hanford wells have been resurveyed using NAVD88, and hydraulic heads are computed using these NAVD88 reference point elevations, if available. However, some of the wells used for water-level measurements have not been resurveyed and have reference point elevations in NGVD29. To prepare water table and potentiometric surface maps, the NGVD29 elevations are converted to NAVD88 using the

Corpscon, Version 6.0.1 software package (*Corpscon, Version 6.x, Technical Documentation and Operating Instructions* [USACE 2004]), which makes use of the VERTCON software program (Version 2.0) developed by the National Geodetic Survey.

The use of the NAVD88 vertical datum, however, does not eliminate the potential for geodetic survey errors. These errors are suspected when hydraulic heads are inconsistent with those in nearby wells over a long time period, and other sources of error are eliminated. Survey error cannot be confirmed until the well is resurveyed; however, such errors are rare and the older data can be corrected to reflect the new survey results.

4.1.4 Measurement Techniques and Instrument Limitations

Measurement transcription is probably the most common cause of errors encountered in water-level data. These errors consist of mistakes in recording a measured water level or in assigning a measured water level to the wrong well. Water-level measurements are recorded on field data sheets, and manual data entry to a database is performed later. Thus, there are two chances for transcription error with these measurements. All manually entered data is verified against the original hard copy documentation prior to loading into the database. To help ensure that water levels are recorded for the proper well, almost all wells on the Hanford Site are identified with the well name written on the casing or stamped on a brass cap set in a cement pad at the well.

Determining the reference point/measurement point offset is another possible source of error in water-level data. It is the responsibility of field personnel to identify the reference point at the well head and to record the vertical offset between the reference point and measurement point if the two points do not coincide. However, at some wells, the reference point is unmarked and its position has to be assumed (usually the top of the outer casing), which can be a source of error. The validity of the reference point/measurement point offsets are reviewed during data verification, and any necessary corrections are made prior to loading into the database.

Water-level measuring devices have limits of accuracy and precision. As described in Section 3.2, measuring tapes are standardized to a calibrated tape before use. Measuring tapes are potentially subject to stretch and thermal expansion, but these factors only become important at high temperatures and measured depths in excess of about 300 m (1,000 ft) (Garber and Koopman 1968). The largest depth to water on the Hanford Site is less than 110 m (360 ft), and temperatures are not significantly high.

4.2 DATA MANAGEMENT

Water-level measurements are stored in a groundwater project database known as HydroDat, and the measurements are made available through the Hanford Environmental Information System (HEIS) database. As mentioned above, prior to loading into HydroDat, the measurements are verified for data entry, and any issues involving reference point identification or the measurement point/reference point offset values are investigated and resolved if possible. Measurements with data quality issues that cannot be resolved at load time are flagged as "P" for potential problem, "Y" for suspect, or "R" for reject in the HydroDat database, as appropriate.

4.3 ANALYSIS AND REPORTING

Water-level data are analyzed (1) to produce water table and potentiometric surface maps for determining groundwater flow directions, and (2) for computing groundwater flow rates. This section describes the techniques employed for these analyses and also describes how the results of water-level monitoring are reported.

4.3.1 Water Table and Potentiometric Surface Generation

Water table and potentiometric surface maps are constructed by manual contouring. Some computer software packages can generate contours from discrete data points, but these packages generally do not produce acceptable results for water-level data because they do not take into account the hydrogeologic framework in which the groundwater occurs. To make the software work properly, much hand-editing and recalculation is necessary, which is not very cost effective.

To generate a contour map, the hydraulic head measurements to be contoured are selected and a map showing the area to be contoured along with the measurements is generated using a Geographic Information System (GIS). These maps are then hand-contoured by a hydrogeologist. The contours are then digitized and stored in the GIS, where they are made available for final map production.

At local scales, such as individual regulated waste sites, groundwater flow directions can be determined by trend-surface analysis (*Statistics and Data Analysis in Geology* [Davis 2002]; "A Spreadsheet Method of Estimating Best-Fit Hydraulic Gradients Using Head Data from Multiple Wells" [Devlin 2003]). With this technique, each observed hydraulic head value is located mathematically using the horizontal survey coordinates of the wells, and then a plane is fitted to the data using least squares regression. The dip direction of the fitted plane represents the direction of the hydraulic gradient, and the magnitude of the gradient is represented by the slope of the fitted plane.

4.3.2 Groundwater Flow Rate Calculations

An annual determination of the direction and rate of groundwater movement is required for regulated units (40 CFR 265.94[b][2], WAC 173-303-645[9][e]). The rate of ground-water flow is estimated from water-level data using a form of the Darcy equation (*Applied Hydrogeology* [Fetter 1988]):

$$v = \frac{Ki}{n_e} \qquad \text{(Equation 4-1)}$$

where:

v = average linear groundwater velocity, length/time
K = hydraulic conductivity, length/time
i = average hydraulic gradient magnitude, length/length
n_e = effective porosity, fraction.

Representative values of hydraulic conductivity, effective porosity, and hydraulic gradient magnitude are used for each site. Values of hydraulic conductivity are taken from published hydrologic test results that best represent the uppermost part of the unconfined aquifer. The value for effective porosity is chosen within the range of values (i.e., 0.1 to 0.3) typical for unconfined aquifer conditions. The hydraulic gradient magnitude is estimated from water table maps or calculated by trend-surface analysis. However, for sites where the water table relief is low, the hydraulic gradient is uncertain and is estimated from regional hydraulic gradient considerations.

In some cases, other methods can be used to estimate groundwater flow rate and direction, including the migration of contaminant plumes, numerical groundwater flow modeling, or hydrochemical/isotopic groundwater age dating. For instance, contaminant plume maps are used to estimate groundwater flow directions to confirm or provide better confidence than flow directions determined by the water table contours. The groundwater flow rate in the upper basalt-confined aquifer system beneath the southern portion of the Hanford Site was estimated in *Hydrochemistry and Hydrogeologic Conditions Within the Hanford Site Upper Basalt Confined Aquifer System* (PNL-10817) using carbon-14 dating of the groundwater, which provided rate estimates that were in close agreement with the hydraulic gradient method (Equation 4-1).

4.3.3 Reporting

The results of surveillance and regulated unit-water level monitoring are published annually in the groundwater monitoring report prepared by the groundwater project (e.g., DOE/RL-2008-01). This report presents the water table map for the Hanford Site, the potentiometric surface map for the upper basalt-confined aquifer system, and a potentiometric surface map for the Ringold Formation confined aquifer. In addition, the report also includes the calculated groundwater flow velocities for each regulated unit if sufficient information is available to make these calculations, as well as a discussion of changes to the groundwater flow system during the previous year. This report also includes an appendix listing the surveillance and regulated unit water-level measurements collected in March and used for water table mapping.

5.0 REFERENCES

40 CFR 265, Subpart F, "Ground-Water Monitoring," *Code of Federal Regulations*.

ASTM, 1988, "Standard Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)," Method D 4750-87, in *Annual Book of ASTM Standards*, American Society for Testing and Materials, Philadelphia, Pennsylvania.

Atomic Energy Act of 1954, Chapter 1073, 68 Stat. 919, 42 U.S.C. 2011, et seq.

BHI-00184, 1995, *Miocene- to Pliocene-Aged Suprabasalt Sediments of the Hanford Site, South-Central Washington*, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, Public Law 96-150, as amended, 94 Stat. 2767, 42 U.S.C. 9601, et seq.

Davis, J. C., 2002, *Statistics and Data Analysis in Geology*, 3rd Edition, John Wiley & Sons, New York.

Devlin, J. F., 2003, "A Spreadsheet Method of Estimating Best-Fit Hydraulic Gradients Using Head Data from Multiple Wells," in *Ground Water*, 41(3):316-320.

DOE O 450.1, *Environmental Protection Program*, U.S. Department of Energy, Washington, D.C.

DOE/RL-2002-39, 2002, *Standardized Stratigraphic Nomenclature for Post-Ringold Formation Sediments Within the Central Pasco Basin*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2007-20, 2008, *Hanford Integrated Groundwater and Vadose Zone Management Plan*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2008-01, 2008, *Hanford Site Groundwater Monitoring for Fiscal Year 2007*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RW-0164, 1988, *Consultation Draft Site Characterization Plan, Reference Repository Location, Hanford Site, Washington*, Vol. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Federal Register, 1993, *Affirmation of Vertical Datum for Surveying and Mapping Activities*, dated June 24, 1993, Doc. 93-14922, 58(120):34245.

Fetter, C. W., 1988, *Applied Hydrogeology*, 2nd Edition, Merrill Publishing Company, Columbus, Ohio.

Garber, M. S., and F. C. Koopman, 1968, *Methods of Measuring Water Levels in Deep Wells*, U.S. Geological Survey, TRWI, Book 8, Chapter A-1, U.S. Government Printing Office, Washington, D.C.

Lindsey, K. A., 1996, *The Miocene to Pliocene Ringold Formation and Associated Deposits of the Ancestral Columbia River System, South-Central Washington and North-Central Oregon*, Open File Report 96-8, Washington Division of Geology and Earth Resources, Washington State Department of Natural Resources, Olympia, Washington.

NWWA/EPA, 1986, *RCRA Ground Water Monitoring Technical Enforcement Guidance Document*, National Water Well Association and U.S. Environmental Protection Agency, Dublin, Ohio.

PNL-8869, 1993, *Preliminary Potentiometric Map and Flow Dynamic Characteristics for the Upper-Basalt Confined Aquifer System*, Rev. 0, Pacific Northwest Laboratory, Richland, Washington.

PNL-10158, 1994, *Summary and Evaluation of Hydraulic Property Data Available for the Hanford Site Upper Basalt Confined Aquifer System*, Rev. 0, Pacific Northwest Laboratory, Richland, Washington.

PNL-10817, 1995, *Hydrochemistry and Hydrogeologic Conditions Within the Hanford Site Upper Basalt Confined Aquifer System*, Rev. 0, Pacific Northwest Laboratory, Richland, Washington.

PNNL-13021, 1999, *Water-Level Monitoring Plan for the Hanford Groundwater Monitoring Project*, Rev. 0, Pacific Northwest National Laboratory, Richland, Washington.

Rasmussen, T. C., and L. A. Crawford, 1997, "Identifying and Removing Barometric Pressure Effects in Confined and Unconfined Aquifers," in *Ground Water*, 35(3):502-511.

Resource Conservation and Recovery Act of 1976, Public Law 94-580, 90 Stat. 2795, 42 U.S.C. 6901, et seq.

RHO-BWI-ST-5, 1979, *Hydrologic Studies Within the Columbia Plateau, Washington: An Integration of Current Knowledge*, Rev. 0, Rockwell Hanford Operations, Richland, Washington.

USACE, 2004, *Corpscon, Version 6.x, Technical Documentation and Operating Instructions*, U.S. Army Corps of Engineers, Engineer Research and Development Center, Topographic Engineering Center, Alexandria, Virginia.

USGS, 1977, *National Handbook of Recommended Methods for Water Data Acquisition*, U.S. Geological Survey, Office of Water Data Coordination, Reston, Virginia.

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," *Washington Administrative Code*.

WAC 173-216, "State Waste Discharge Permit Program," *Washington Administrative Code*.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*.

WAC 173-304, "Minimum Functional Standards for Solid Waste Handling," *Washington Administrative Code*.

APPENDIX A

WELL NETWORK FOR WATER-LEVEL MONITORING

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APPENDIX A

WELL NETWORK FOR WATER-LEVEL MONITORING

This appendix lists all wells used by the groundwater project for water-level monitoring during fiscal year 2008 (FY08). This network forms the basis for future water-level monitoring and will be revised as needed. The relative monitoring zone classification scheme, listed in the main body of the report in Table 3-2, is repeated below in Table A-1 for easy reference. Wells in the unconfined aquifer system are listed in Table A-2. For each well in this table, the following information is provided: well name, well identification, reference point elevation in meters above mean sea level in the North American Vertical Datum of 1988 (NAVD88), source of the reference point elevation (i.e., NAVD88 survey or a conversion from an NGVD29 survey using the software program VERTCON), relative monitoring zone, and whether the well is suitable for use in water table mapping.

Tables A-3 and A-4 list the upper basalt-confined aquifer system and lower basalt-confined aquifer wells, respectively. Just as for Table A-2, the well name, identification, reference point elevation, and elevation source are given. In addition, the hydrogeologic units monitored are also listed for each well.

Table A-5 lists the water-level monitoring networks in use for regulated unit monitoring during FY08 and are grouped by site. This list is provided for information purposes only; the specific well networks in use are determined by the project scientist responsible for each facility and are subject to change.

Figures A-1 through A-13 show all of the wells used for water-level monitoring by the groundwater project during FY08.

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Figure A-1. Water-Level Monitoring Network for the Hanford Site.

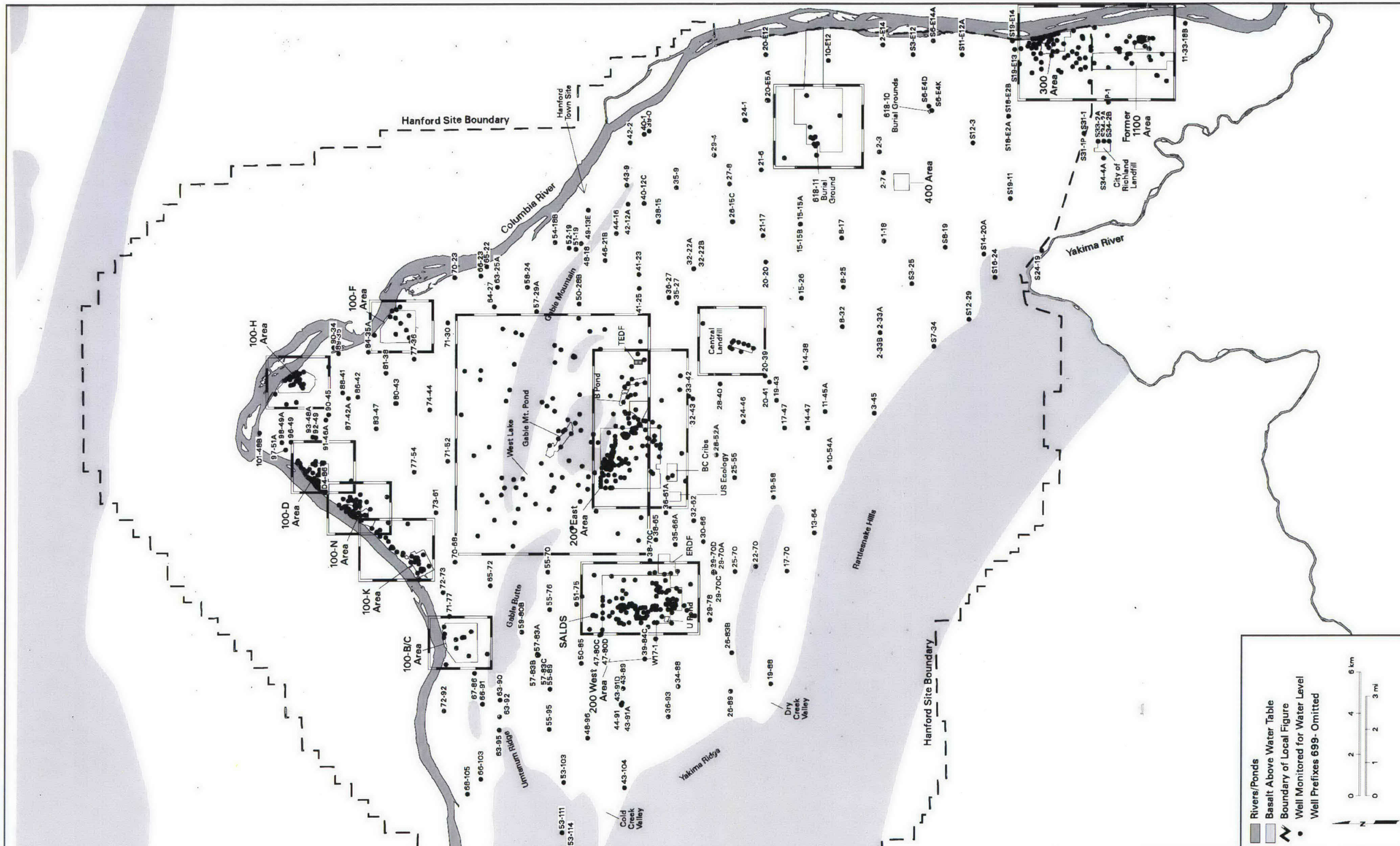

Figure A-2. Water-Level Monitoring Network for the 100-B/C Area.

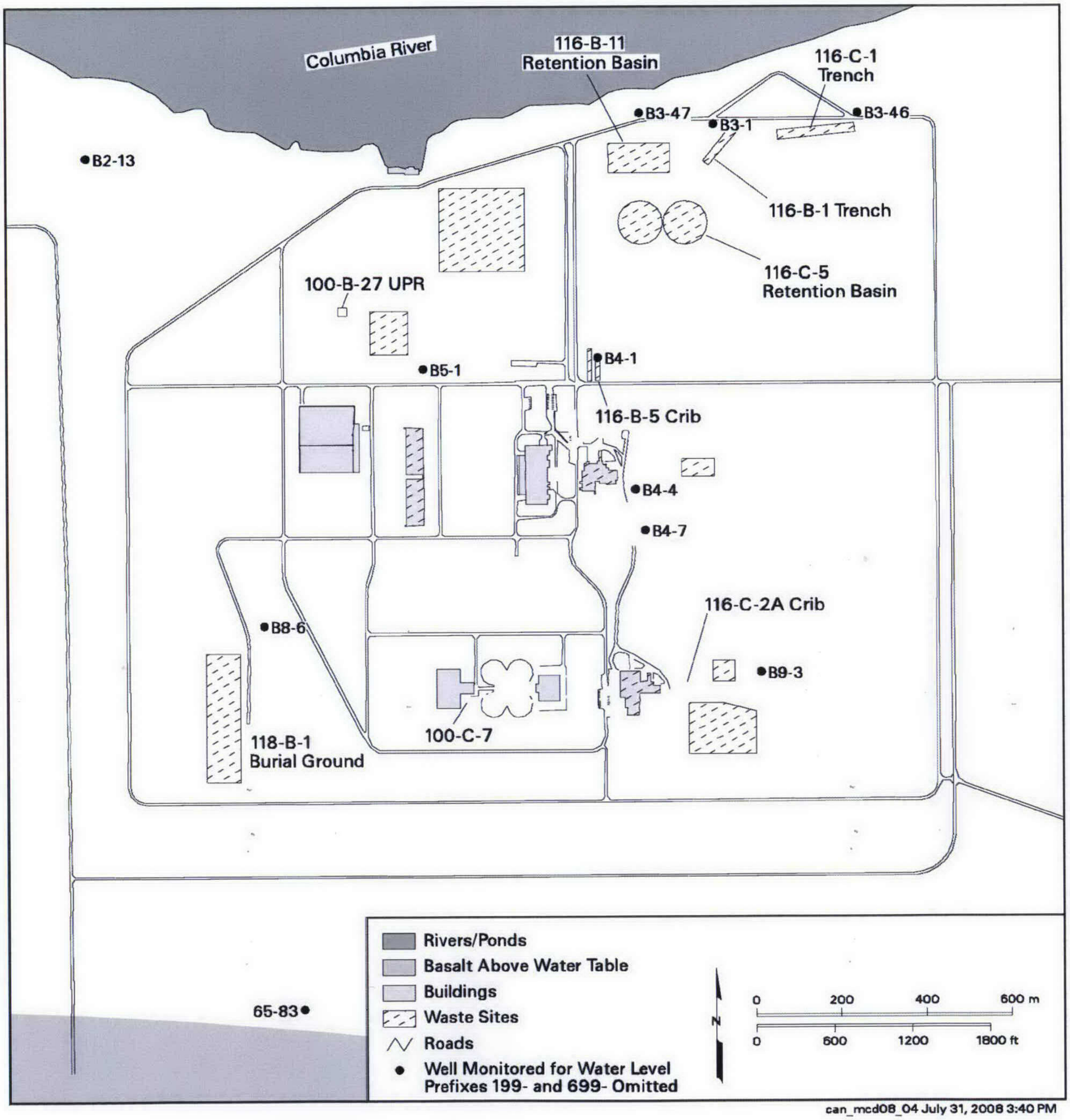

Figure A-3. Water-Level Monitoring Network for the 100-K Area.

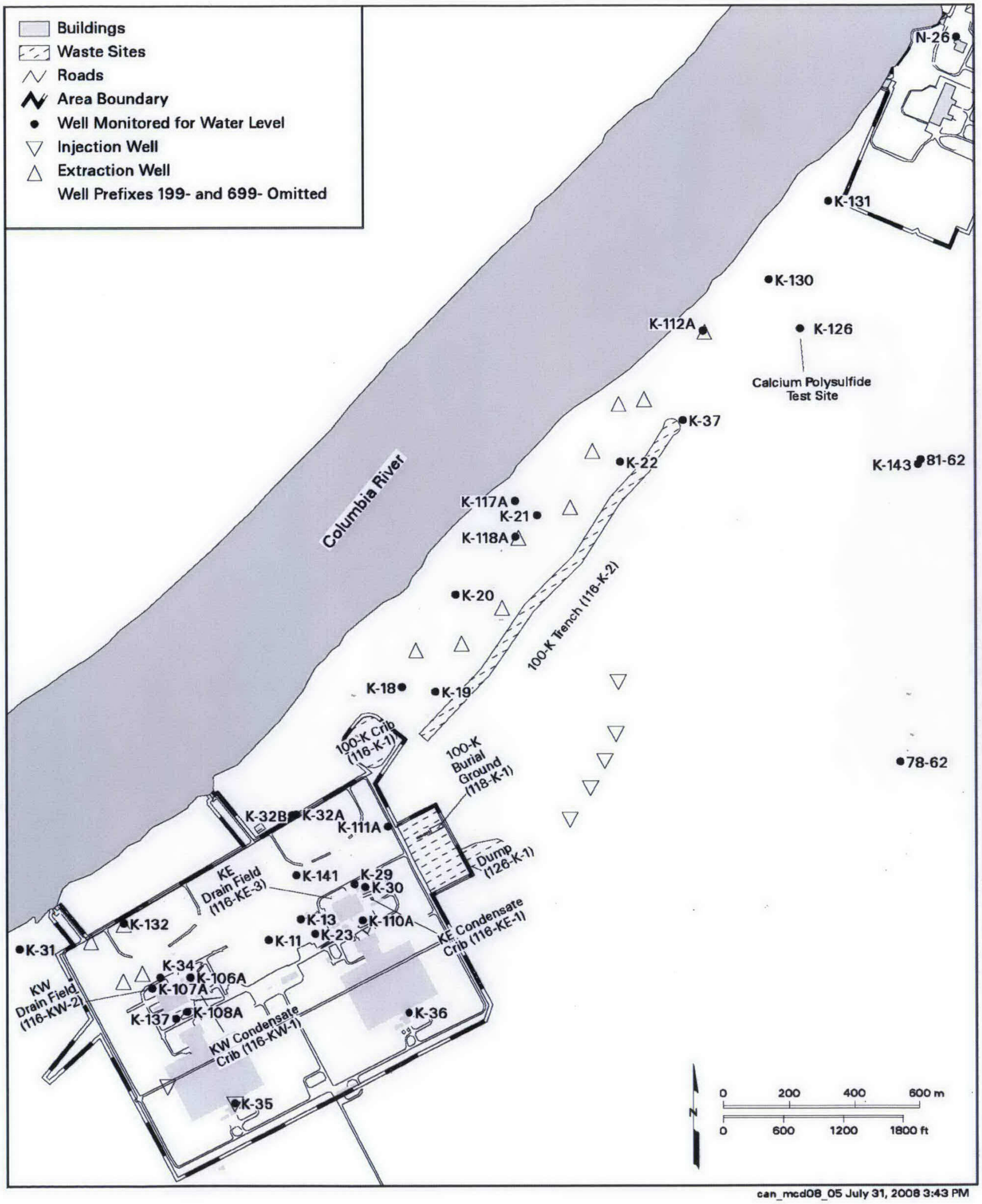

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Figure A-4. Water-Level Monitoring Network for the 100-N Area.

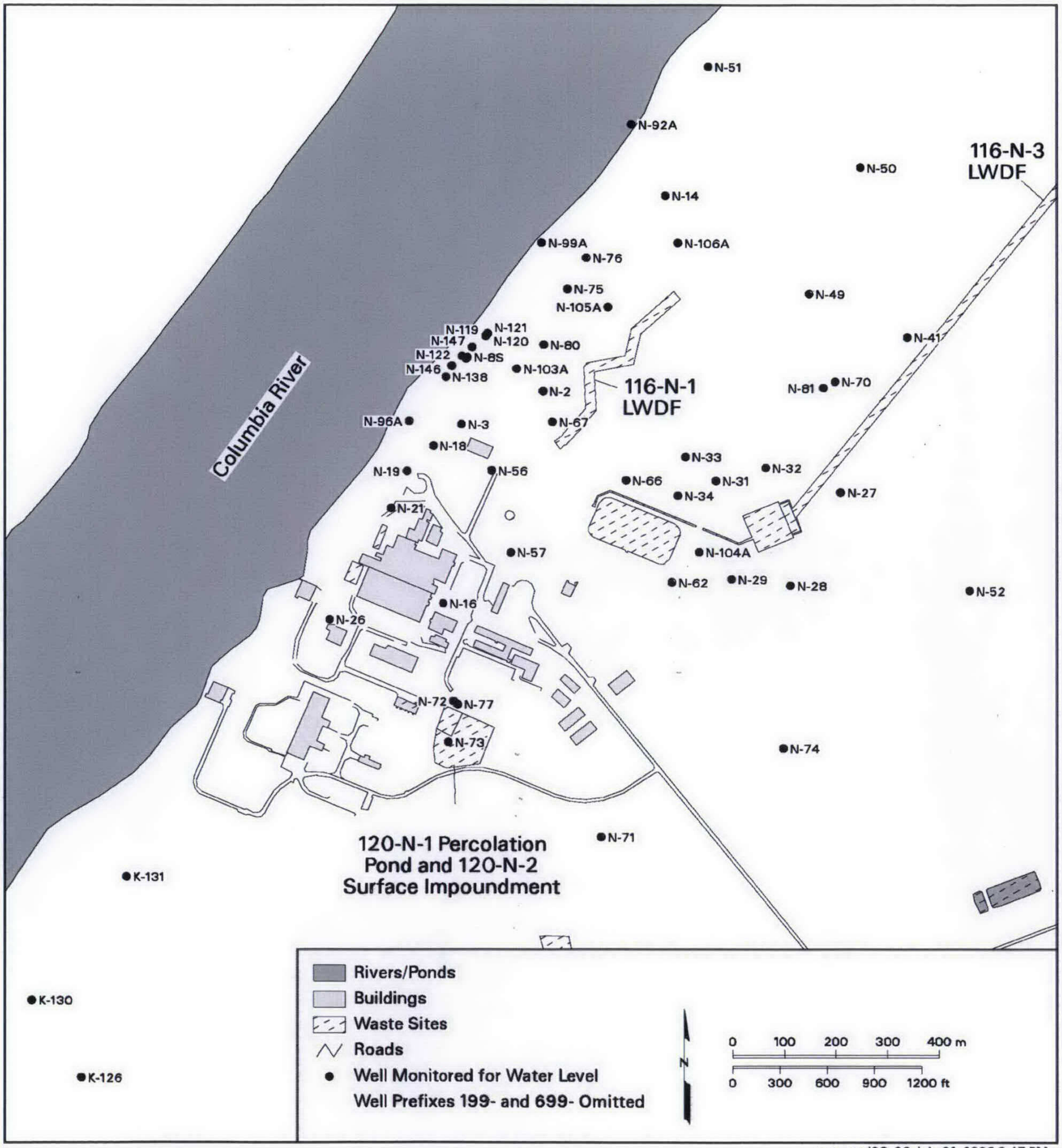

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Figure A-5. Water-Level Monitoring Network for the 100-D Area.

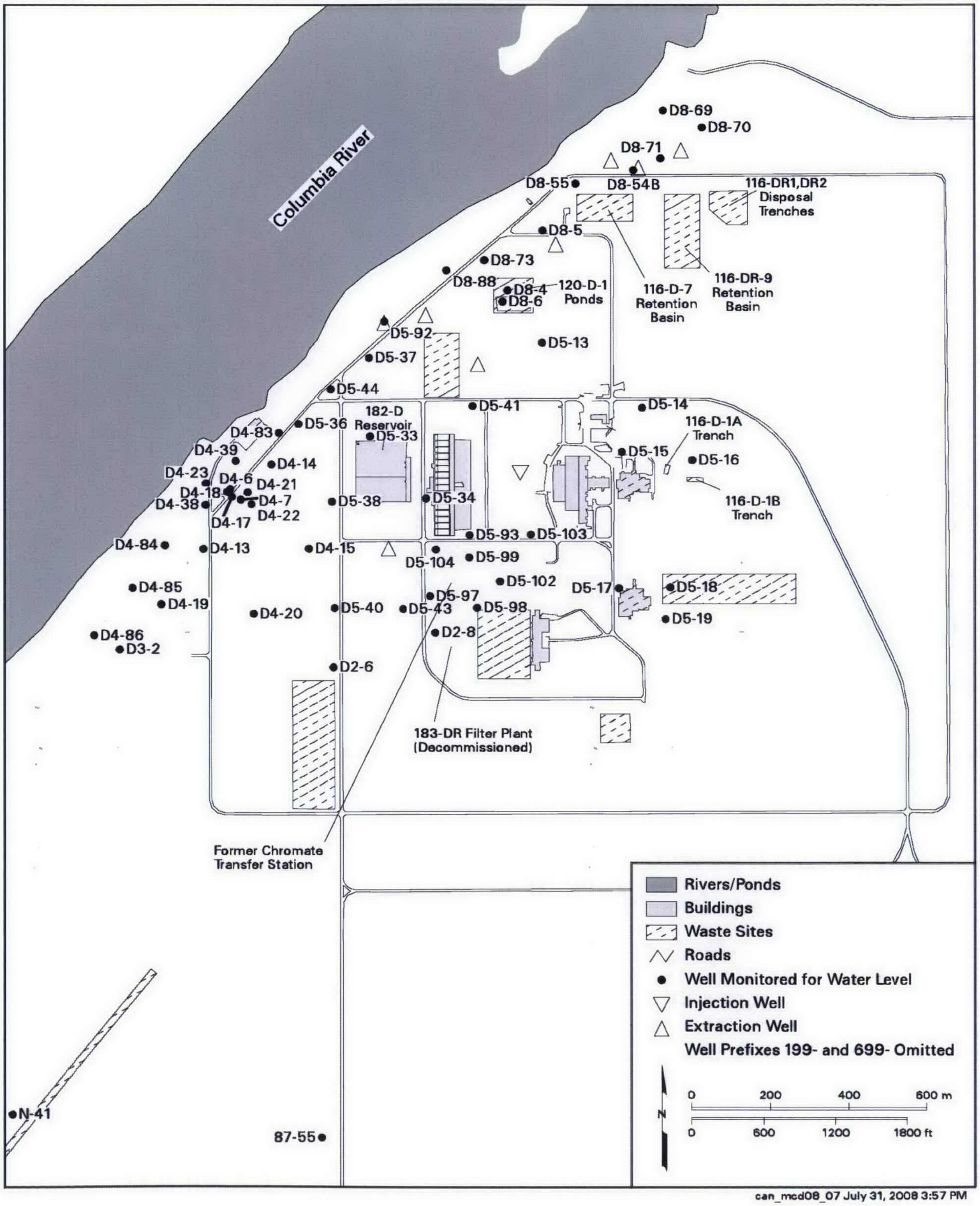

Figure A-6. Water-Level Monitoring Network for the 100-H Area.

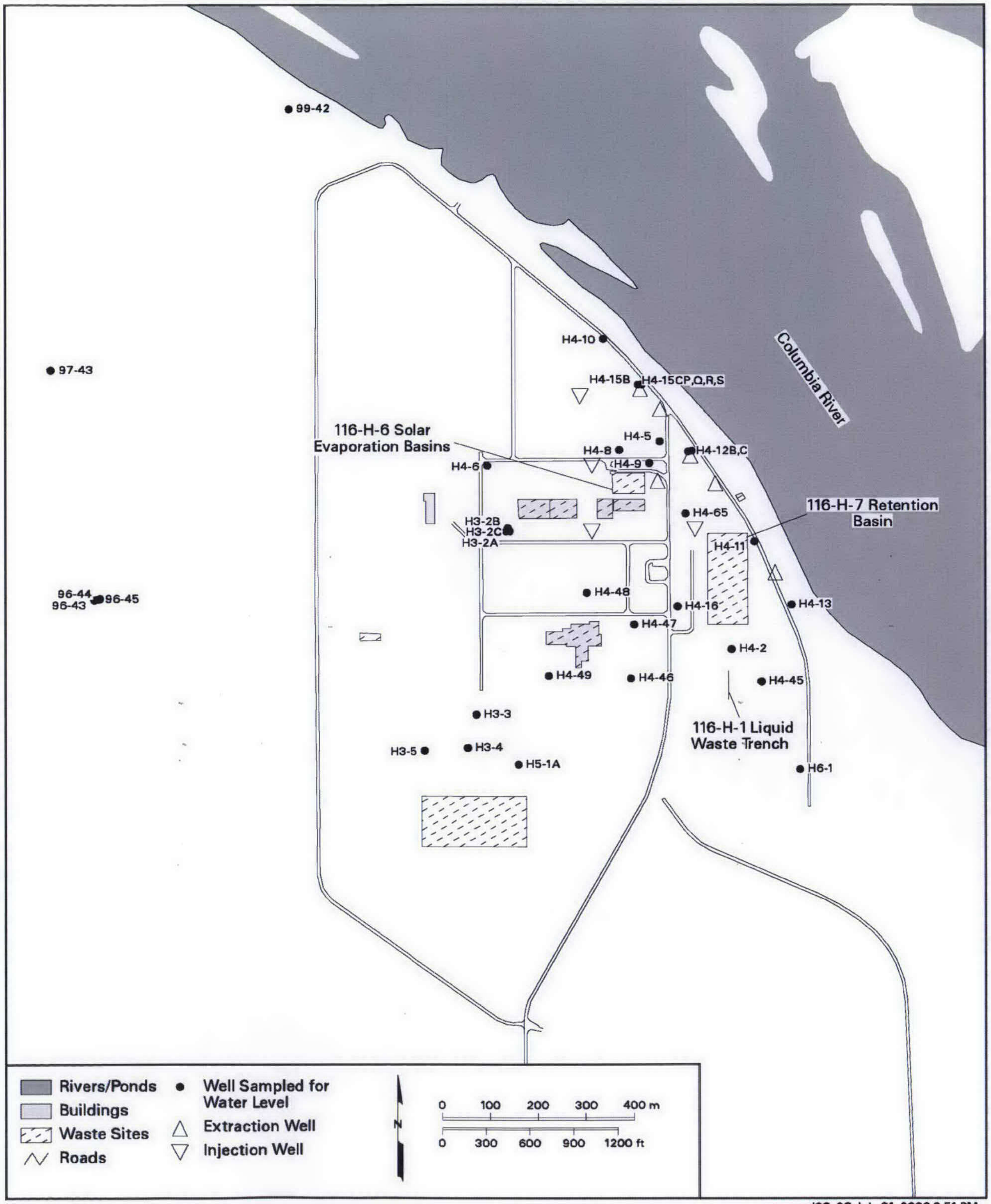

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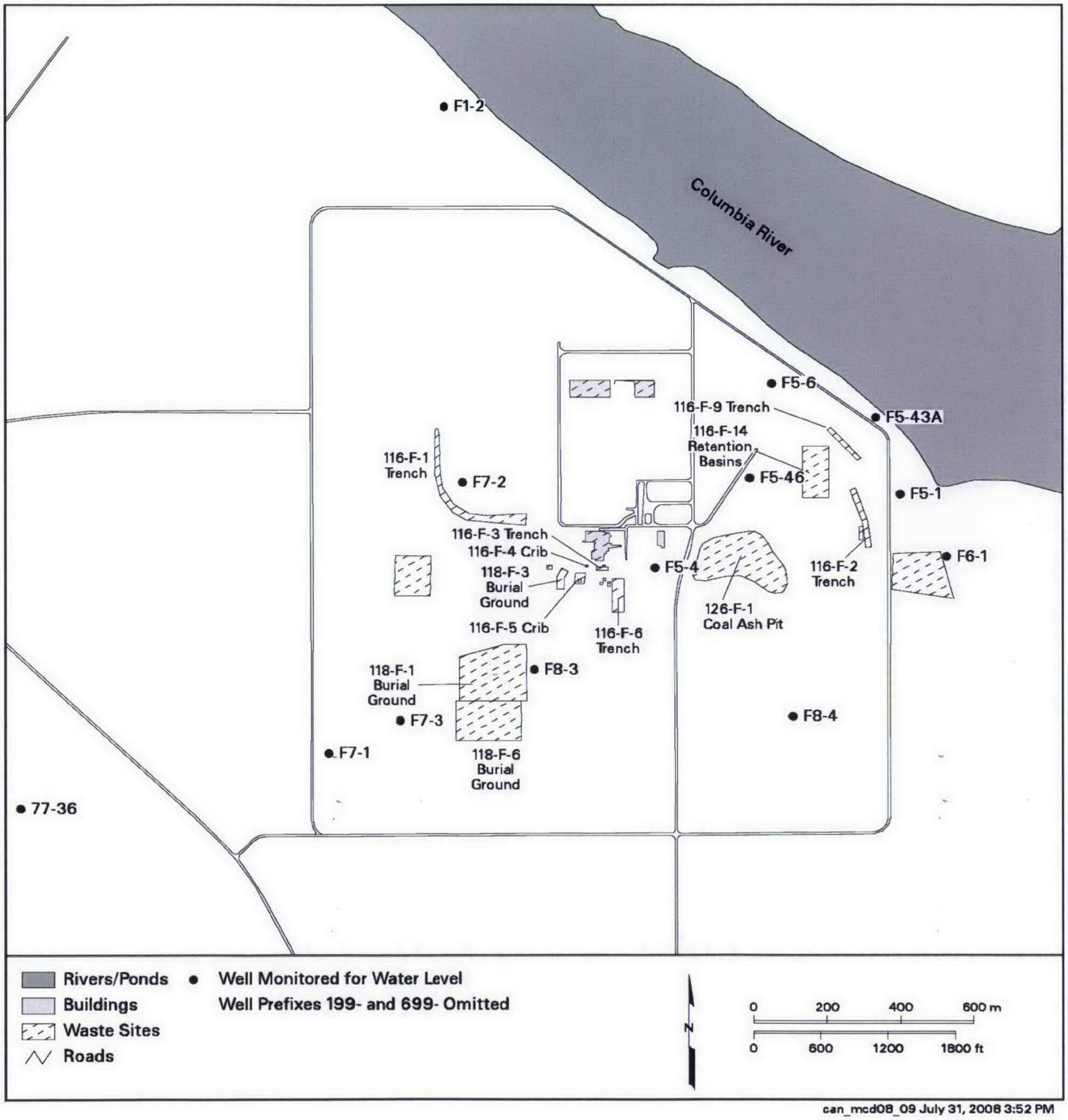
Figure A-7. Water-Level Monitoring Network for the 100-F Area.



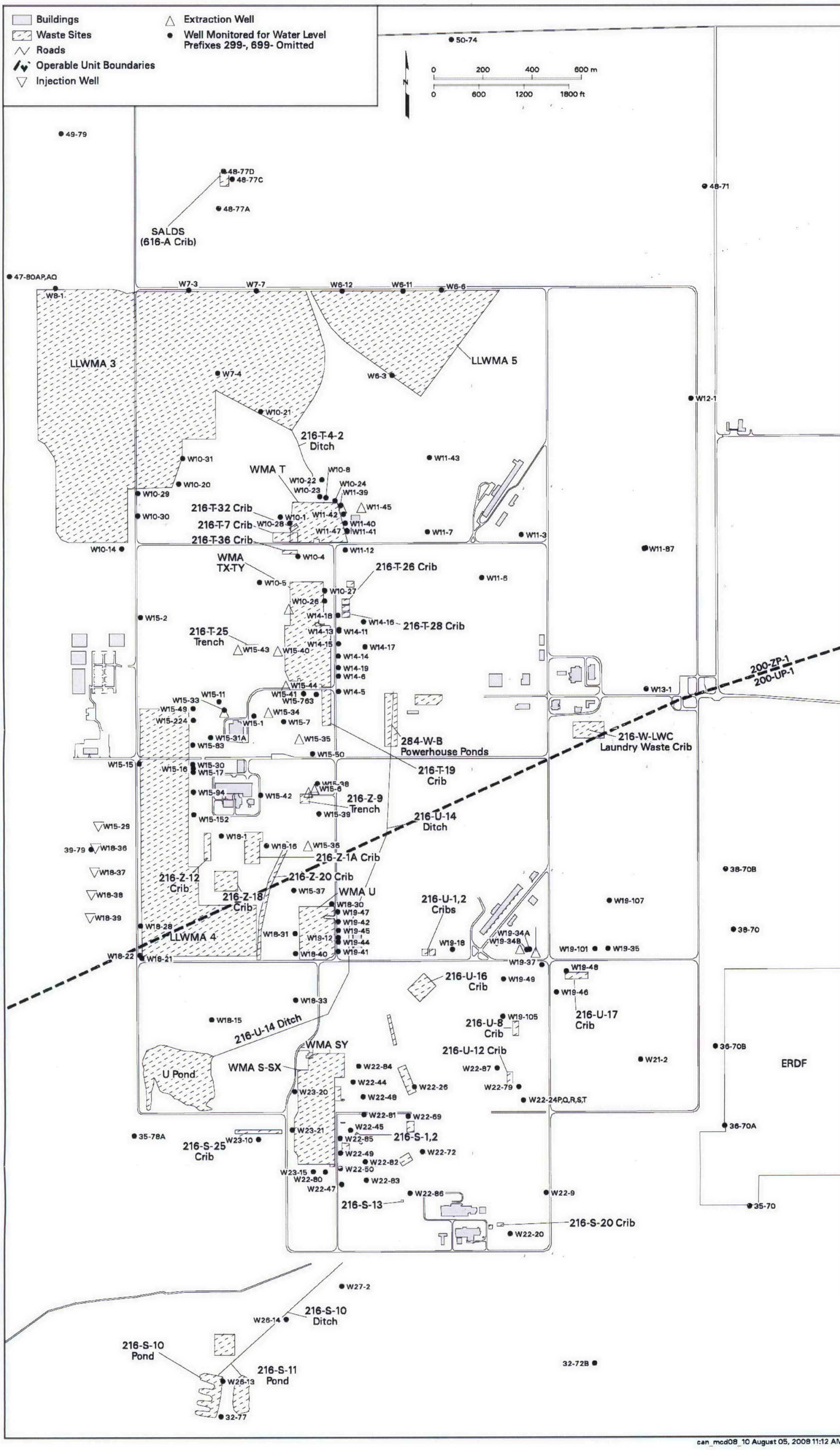
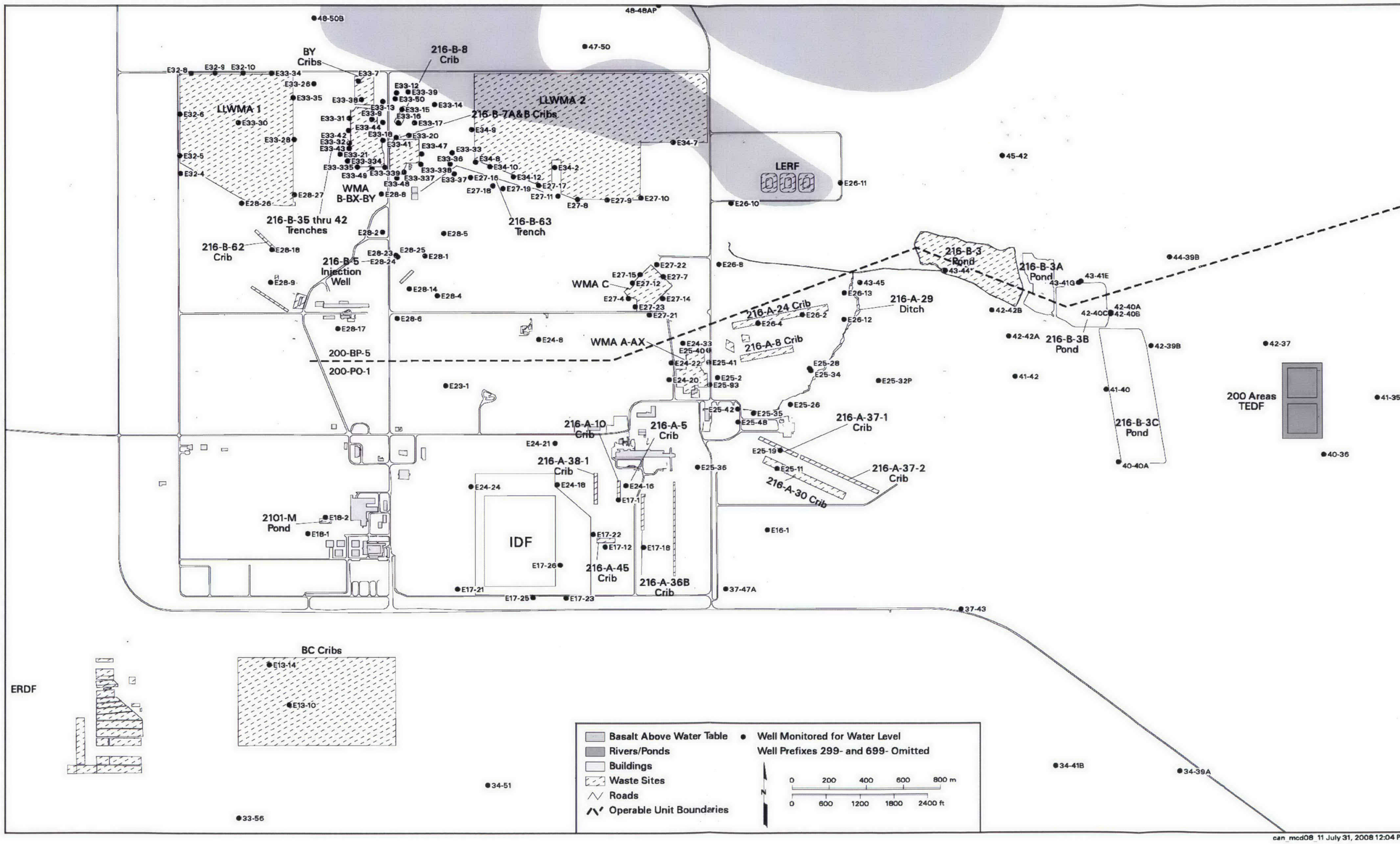


Figure A-8. Water-Level Monitoring Network for the 200 West Area.

Figure A-9. Water-Level Monitoring Network for the 200 East Area.



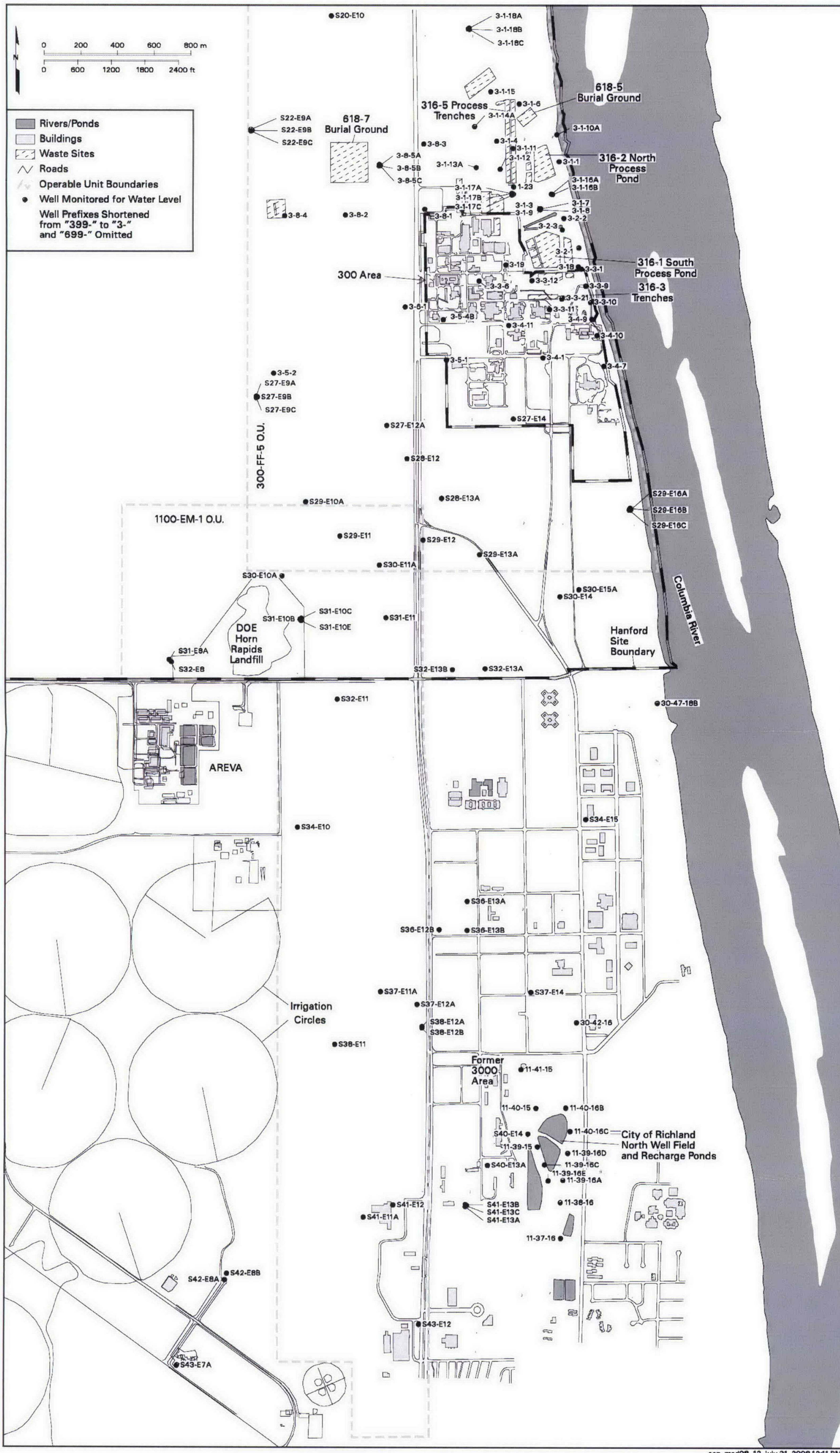


Figure A-10. Water-Level Monitoring Network for the 300 and Former 1100 Areas.

Figure A-11. Water-Level Monitoring Network North of the 200 East Area (200-BP-5 Operable Unit).

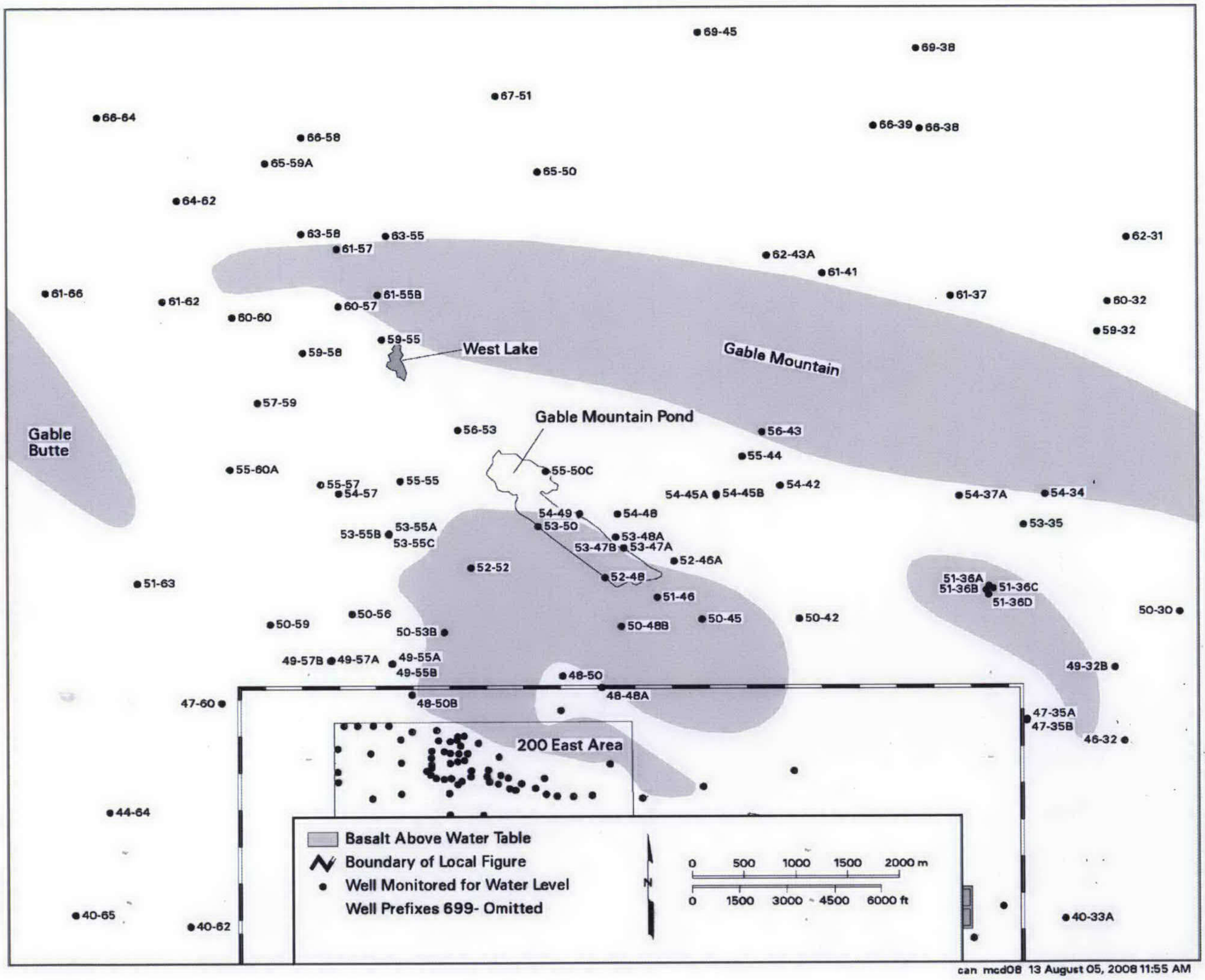


Figure A-12. Water-Level Monitoring Network for the Central Landfill.

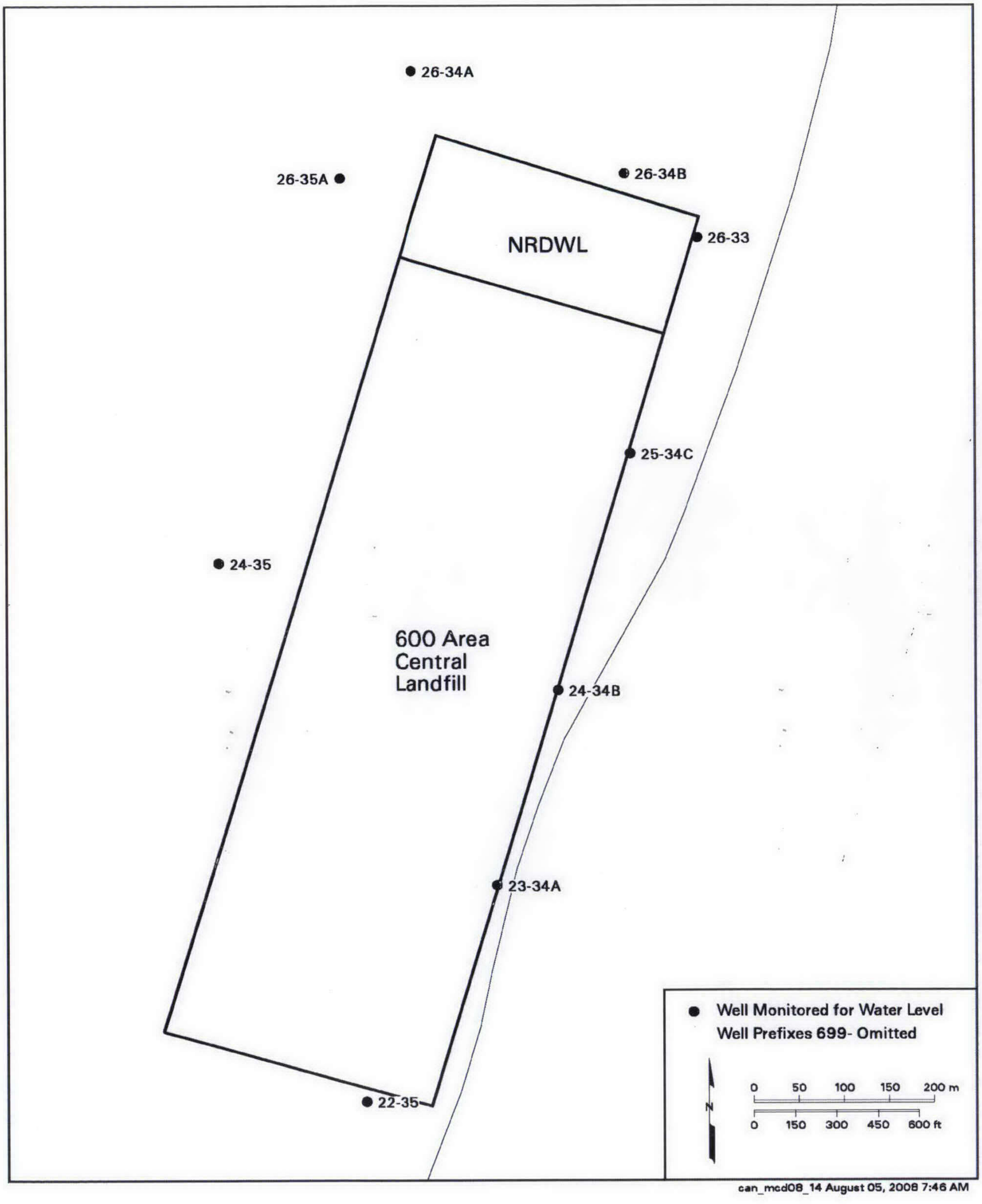


Figure A-13. Water-Level Monitoring Network for the 618-11 Burial Ground.

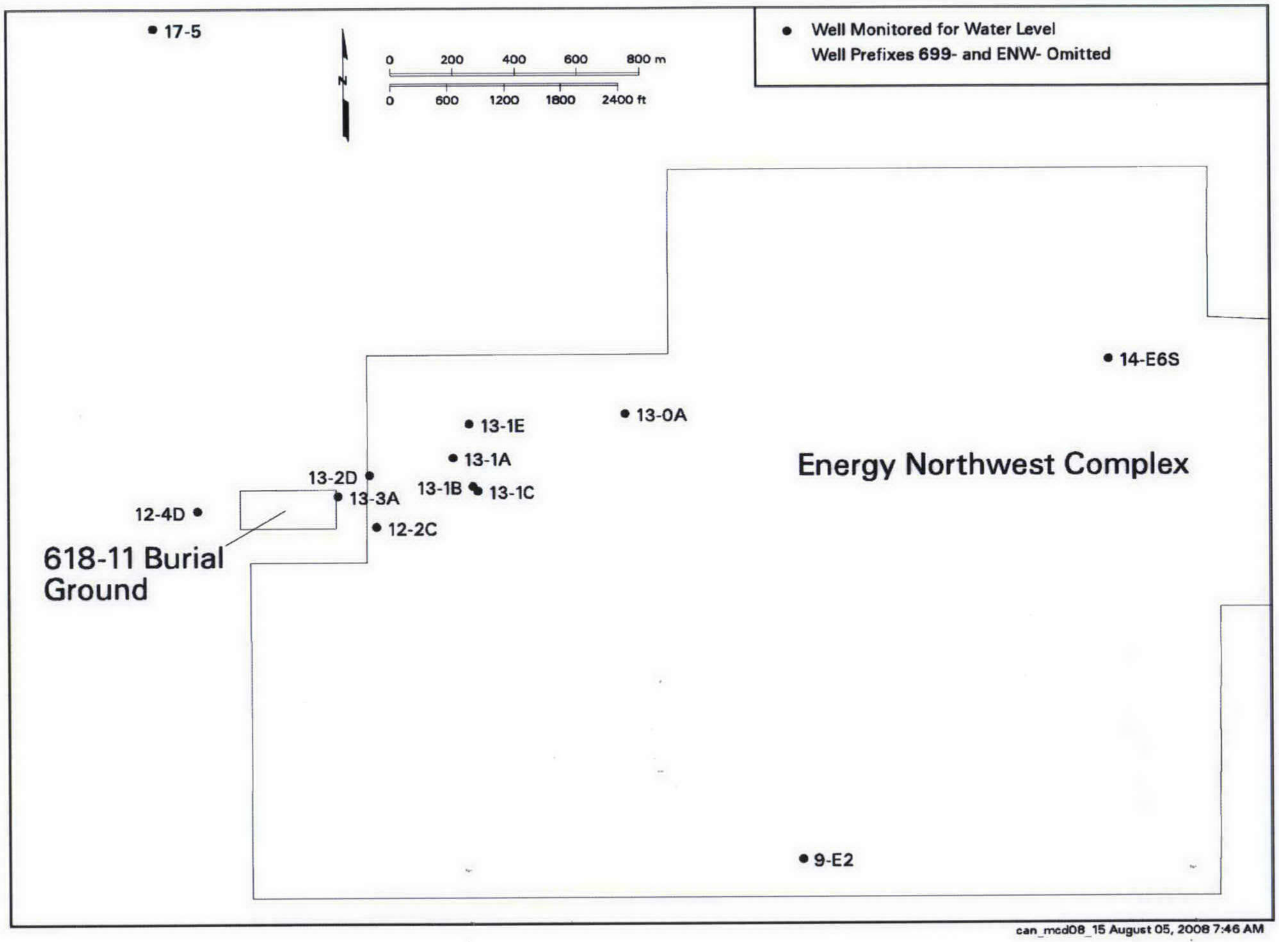


Table A-1. Relative Monitoring Zone Classification Scheme.

Zone	Description
U	(Undifferentiated unconfined) Open to more than 15.2 m (50 ft) of the unconfined aquifer system, or the open/monitoring interval depth is not documented but is known to be within the unconfined aquifer system.
TU	(Top of unconfined) Screened across the water table or the top of the open interval is within 1.5 m (5 ft) of the water table, and the bottom of the open interval is no more than 10.7 m (35 ft) below the water table.
UU	(Upper unconfined) The top of the open interval is more than 1.5 m (5 ft) below the water table and the bottom of the open interval is no more than 15.2 m (50 ft) below the water table.
MU	(Middle unconfined) Open interval begins at greater than 15.2 m (50 ft) below the water table and does not extend below the middle coarse hydrogeologic unit or to within 15.2 m (50 ft) of the top of basalt.
LU	(Lower unconfined) Open interval begins at greater than 15.2 m (50 ft) below the water table and below the middle coarse hydrogeologic unit or within 15.2 m (50 ft) of the top of basalt and does not extend more than 3 m (10 ft) below the top of basalt.
CR	(Confined Ringold) Artesian wells for which the open interval does not extend more than 3.0 m (10 ft) below the top of basalt. Typically open to the lower mud and basal coarse hydrogeologic units of the Ringold Formation.
TB	(Top of basalt) Bottom of the open interval is more than 3 m (10 ft) but not more than 9.1 m (30 ft) below the top of basalt.
C	(Undifferentiated basalt-confined) Open interval extends across the dense interior of the Pomona Member of the Saddle Mountains Basalt, or open/monitoring interval depth is not documented but is known to be within the basalt confined aquifers.
UC	(Upper basalt-confined) Open to the upper basalt-confined aquifer system (i.e., does not extend below the dense interior of the Pomona Member of the Saddle Mountains Basalt).
LC	(Lower basalt-confined) Open to the basalt and interflow zones below the dense interior of the Pomona Member of the Saddle Mountains Basalt.

C = undifferentiated basalt-confined
CR = confined Ringold
MU = middle unconfined
LU = lower unconfined
ID = identification
LC = lower basalt-confined
TB = top of basalt
TU = top of unconfined
U = undifferentiated unconfined
UC = upper basalt-confined
UU = upper unconfined

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
1199-33-18B	A9335	116.425	Survey	U	Yes
1199-37-16	A9352	111.836	Survey	U	Yes
1199-38-16	A9355	112.688	VERTCON	U	Yes
1199-39-15	A9358	121.122	VERTCON	U	Yes
1199-39-16A	A9359	113.124	VERTCON	U	Yes
1199-39-16C	A9361	121.302	VERTCON	U	Yes
1199-39-16D	A9362	114.313	VERTCON	U	Yes
1199-39-16E	A9363	122.344	VERTCON	U	Yes
1199-40-15	A9365	122.415	VERTCON	U	Yes
1199-40-16B	A9367	120.525	VERTCON	U	Yes
1199-40-16C	A9368	117.251	VERTCON	U	Yes
1199-41-15	A9371	122.529	Survey	U	Yes
199-B2-13	A4551	128.600	Survey	TU	Yes
199-B3-1	A4552	134.882	Survey	TU	Yes
199-B3-46	A4553	135.632	Survey	TU	Yes
199-B3-47	A4554	134.766	Survey	TU	Yes
199-B4-1	A4555	141.600	Survey	TU	Yes
199-B4-4	A4557	145.365	Survey	TU	Yes
199-B4-7	A5541	147.990	Survey	TU	Yes
199-B5-1	A4561	139.892	Survey	TU	Yes
199-B8-6	A4563	145.928	Survey	TU	Yes
199-B9-3	A4566	151.313	Survey	TU	Yes
199-D2-6	A4568	144.092	VERTCON	TU	Yes
199-D2-8	C3040	144.335	Survey	TU	Yes
199-D3-2	B8074	143.789	Survey	TU	Yes
199-D4-13	B8071	143.831	Survey	TU	Yes
199-D4-14	B8072	144.338	Survey	TU	Yes
199-D4-15	B8073	144.565	Survey	TU	Yes
199-D4-17	B8459	144.234	Survey	TU	Yes
199-D4-18	B8460	144.877	Survey	TU	Yes
199-D4-19	B8746	143.890	Survey	TU	Yes
199-D4-20	B8750	144.251	Survey	TU	Yes
199-D4-21	B8755	144.354	Survey	TU	Yes
199-D4-22	B8778	144.807	Survey	TU	Yes
199-D4-23	B8779	141.124	Survey	TU	Yes
199-D4-38	B8989	143.553	Survey	TU	Yes
199-D4-39	B8990	143.895	Survey	TU	Yes
199-D4-6	B8064	144.023	Survey	UU	Yes
199-D4-7	B8065	144.247	Survey	UU	Yes
199-D4-83	C3315	143.625	Survey	TU	Yes
199-D4-84	C3316	144.319	Survey	TU	Yes
199-D4-85	C3317	144.040	Survey	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
199-D4-86	C3318	143.288	Survey	TU	Yes
199-D5-102	C5398	144.499	Survey	TU	Yes
199-D5-103	C5399	144.320	Survey	TU	Yes
199-D5-104	C5400	144.805	Survey	TU	Yes
199-D5-13	A4570	144.713	Survey	TU	Yes
199-D5-14	A4571	144.829	VERTCON	TU	Yes
199-D5-15	A4572	144.780	VERTCON	TU	Yes
199-D5-16	A4573	145.195	VERTCON	TU	Yes
199-D5-17	A4574	144.158	VERTCON	TU	Yes
199-D5-18	A4575	143.302	VERTCON	TU	Yes
199-D5-19	A4576	142.729	VERTCON	TU	Yes
199-D5-33	C4186	144.195	Survey	TU	Yes
199-D5-34	C4187	145.317	Survey	TU	Yes
199-D5-36	B8744	143.855	Survey	TU	Yes
199-D5-37	B8745	143.066	Survey	TU	Yes
199-D5-38	B8747	144.697	Survey	TU	Yes
199-D5-40	B8749	144.718	Survey	TU	Yes
199-D5-41	B8751	144.144	Survey	TU	Yes
199-D5-43	B8753	144.514	Survey	TU	Yes
199-D5-44	B8754	143.438	Survey	TU	Yes
199-D5-92	C4583	143.181	Survey	TU	Yes
199-D5-93	C4672	144.657	Survey	TU	Yes
199-D5-97	C5390	144.495	Survey	TU	Yes
199-D5-98	C5391	143.732	Survey	TU	Yes
199-D5-99	C5392	144.669	Survey	TU	Yes
199-D8-4	A4579	143.873	Survey	TU	Yes
199-D8-5	A4580	138.922	Survey	TU	Yes
199-D8-54B	A4583	135.935	VERTCON	MU	No
199-D8-55	A4584	136.481	Survey	TU	Yes
199-D8-6	A4585	146.244	Survey	TU	Yes
199-D8-69	B2773	131.513	Survey	TU	Yes
199-D8-70	B2774	132.940	Survey	TU	Yes
199-D8-71	B2775	134.656	Survey	TU	Yes
199-D8-73	C4474	142.504	Survey	TU	Yes
199-D8-88	C4536	141.818	Survey	TU	Yes
199-F1-2	A4586	122.328	Survey	TU	Yes
199-F5-1	A4587	124.574	Survey	TU	Yes
199-F5-4	A4590	126.642	Survey	TU	Yes
199-F5-43A	A4592	121.536	Survey	TU	Yes
199-F5-46	A4596	128.118	Survey	TU	Yes
199-F5-6	A4600	127.036	Survey	TU	Yes
199-F6-1	A4602	124.523	Survey	TU	Yes
199-F7-1	A4603	120.050	Estimate	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
199-F7-2	A4604	121.278	Survey	TU	Yes
199-F7-3	A4605	121.374	Survey	TU	Yes
199-F8-3	A4608	122.863	Survey	TU	Yes
199-F8-4	A4609	126.275	Survey	TU	Yes
199-H3-2A	A4611	128.007	Survey	TU	No
199-H3-2B	A4612	128.716	Survey	TU	Yes
199-H3-2C	A4613	128.662	Survey	MU	No
199-H3-3	B2778	128.053	Survey	TU	Yes
199-H3-4	B2779	126.461	Survey	TU	Yes
199-H3-5	B2780	126.291	Survey	TU	Yes
199-H4-10	A4614	124.462	Survey	TU	Yes
199-H4-11	A4615	127.680	Survey	TU	No
199-H4-12B	A4617	127.223	Survey	UU	Yes
199-H4-12C	A4618	127.226	Survey	MU	No
199-H4-13	A4619	128.650	Survey	TU	Yes
199-H4-15B	A4622	125.212	Survey	TU	Yes
199-H4-15CP	A9496	125.259	Survey	TB	No
199-H4-15CQ	A4623	125.319	Survey	CR	No
199-H4-15CR	A4624	125.349	Survey	LU	No
199-H4-15CS	A4625	125.370	Survey	MU	No
199-H4-16	A4626	130.491	Survey	TU	Yes
199-H4-45	A4631	128.011	Survey	TU	Yes
199-H4-46	A4632	130.310	Survey	TU	Yes
199-H4-47	A4633	130.531	Survey	TU	Yes
199-H4-48	A4634	130.870	Survey	TU	Yes
199-H4-49	A4635	130.513	Survey	TU	Yes
199-H4-5	A4636	128.058	Survey	TU	Yes
199-H4-6	A4637	129.069	Survey	TU	Yes
199-H4-65	B8759	129.196	Survey	TU	Yes
199-H4-8	A4639	129.206	Survey	TU	Yes
199-H4-9	A4640	128.615	Survey	TU	Yes
199-H5-1A	A4641	129.078	Survey	TU	Yes
199-H6-1	A4642	128.457	Survey	TU	Yes
199-K-106A	A9842	143.460	Survey	TU	Yes
199-K-107A	A9843	143.566	Survey	TU	Yes
199-K-108A	A9844	143.748	Survey	TU	Yes
199-K-11	A4643	143.224	Survey	TU	Yes
199-K-110A	A9829	143.669	Survey	TU	Yes
199-K-111A	A9830	141.858	Survey	TU	Yes
199-K-112A	B2799	127.458	Survey	TU	Yes
199-K-117A	B2804	128.014	Survey	TU	Yes
199-K-118A	B2805	130.327	Survey	TU	Yes
199-K-126	B8760	140.491	Survey	TU	No

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
199-K-13	A4644	142.949	Survey	U	No
199-K-130	C4120	134.359	Survey	TU	Yes
199-K-131	C4561	135.138	Survey	TU	Yes
199-K-132	C4670	136.755	Survey	TU	Yes
199-K-137	C5112	144.225	Survey	TU	Yes
199-K-141	C5303	142.320	Survey	TU	Yes
199-K-143	C5305	136.498	Survey	UU	Yes
199-K-18	A4647	125.984	Survey	TU	Yes
199-K-19	A4648	129.687	Survey	TU	Yes
199-K-20	A4649	129.639	Survey	TU	Yes
199-K-21	A4650	129.561	Survey	TU	Yes
199-K-22	A4651	130.408	Survey	TU	Yes
199-K-23	A4652	143.732	Survey	TU	Yes
199-K-29	A5480	143.493	Survey	TU	Yes
199-K-30	A4655	143.132	Survey	TU	Yes
199-K-31	A4656	126.731	Survey	UU	Yes
199-K-32A	A4657	136.396	VERTCON	TU	Yes
199-K-32B	A4658	136.777	VERTCON	LU	No
199-K-34	A4660	143.733	VERTCON	TU	Yes
199-K-35	A4661	151.798	VERTCON	TU	Yes
199-K-36	A4662	151.652	VERTCON	TU	Yes
199-K-37	A4663	135.680	Survey	TU	Yes
199-N-103A	A9988	140.777	Survey	TU	Yes
199-N-104A	A9989	141.911	Survey	TU	Yes
199-N-105A	B2408	140.655	Survey	TU	Yes
199-N-106A	B2538	144.625	Survey	TU	Yes
199-N-119	C4471	123.195	Survey	TU	Yes
199-N-120	C4472	123.034	Survey	MU	No
199-N-121	C4473	123.078	Survey	MU	No
199-N-122	C4954	122.334	Survey	TU	Yes
199-N-138	C5044	123.128	Survey	TU	Yes
199-N-14	A4664	139.219	Survey	TU	Yes
199-N-146	C5052	122.411	Survey	TU	Yes
199-N-147	C5116	122.240	Survey	TU	Yes
199-N-16	A4665	140.393	Survey	TU	Yes
199-N-18	A4667	140.945	Survey	TU	Yes
199-N-19	A4668	139.538	Survey	TU	Yes
199-N-2	A4669	141.161	Survey	TU	Yes
199-N-21	A4671	140.462	Survey	TU	Yes
199-N-26	A4675	140.093	Survey	TU	Yes
199-N-27	A4676	138.061	Survey	TU	Yes
199-N-28	A4677	142.678	Survey	TU	Yes
199-N-29	A4678	142.987	Survey	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
199-N-3	A4679	141.047	Survey	TU	Yes
199-N-31	A4680	142.189	Survey	TU	Yes
199-N-32	A4681	142.022	Survey	TU	Yes
199-N-33	A4682	141.346	Survey	TU	Yes
199-N-34	A4683	141.278	Survey	TU	Yes
199-N-41	A4689	140.657	Survey	TU	Yes
199-N-49	A4692	138.568	Survey	TU	Yes
199-N-50	A4693	142.423	Survey	TU	Yes
199-N-51	A4694	142.061	Survey	TU	Yes
199-N-52	A4695	142.514	Survey	TU	Yes
199-N-56	A4699	140.803	Survey	TU	Yes
199-N-57	A4700	140.703	Survey	TU	Yes
199-N-62	A4706	142.487	Survey	TU	Yes
199-N-66	A4710	142.993	Survey	TU	Yes
199-N-67	A4711	140.920	Survey	TU	Yes
199-N-70	A4713	139.619	Survey	MU	No
199-N-71	A4714	142.152	Survey	TU	Yes
199-N-72	A4715	140.921	Survey	TU	Yes
199-N-73	A4716	142.226	Survey	TU	Yes
199-N-74	A4717	140.513	Survey	TU	Yes
199-N-75	A4718	140.282	VERTCON	TU	Yes
199-N-76	A4719	138.862	VERTCON	TU	Yes
199-N-77	A5442	141.058	Survey	MU	No
199-N-80	A4720	140.526	Survey	MU	No
199-N-81	A5443	142.067	Survey	TU	Yes
199-N-8P	A5816	124.675	Survey	LU	No
199-N-8S	A4721	124.507	Survey	TU	Yes
199-N-92A	A9878	122.083	Survey	TU	Yes
199-N-96A	A9882	123.642	Survey	TU	Yes
199-N-99A	A9910	121.653	Survey	TU	Yes
299-E13-10	A4724	226.312	Survey	TU	Yes
299-E13-14	A4726	228.237	Survey	TU	Yes
299-E17-1	A4728	220.311	Survey	TU	Yes
299-E17-12	A4730	221.092	Survey	TU	Yes
299-E17-18	A4736	220.758	Survey	TU	Yes
299-E17-21	B8500	225.300	Survey	TU	Yes
299-E17-22	C3826	221.458	Survey	UU	Yes
299-E17-23	C3827	224.659	Survey	UU	Yes
299-E17-25	C3926	225.791	Survey	UU	Yes
299-E17-26	C4648	225.129	Survey	TU	Yes
299-E18-1	A4743	220.647	Survey	TU	Yes
299-E18-2	A4744	220.948	Survey	TU	Yes
299-E23-1	A4747	218.382	Survey	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
299-E24-16	A4751	220.023	Survey	TU	Yes
299-E24-18	A4753	220.349	Survey	TU	Yes
299-E24-20	A4756	211.157	VERTCON	TU	Yes
299-E24-21	C3177	218.643	Survey	TU	Yes
299-E24-22	C4123	210.285	Survey	UU	Yes
299-E24-24	C4647	221.217	Survey	TU	Yes
299-E24-33	C4257	206.801	Survey	UU	Yes
299-E24-8	A4758	210.901	Survey	TU	Yes
299-E25-11	A4761	208.740	Survey	U	No
299-E25-19	A4765	207.498	Survey	TU	Yes
299-E25-2	A4766	206.954	Survey	U	Yes
299-E25-26	A4771	204.847	Survey	UU	Yes
299-E25-28	A4773	203.000	Survey	LU	No
299-E25-32P	A4779	205.032	VERTCON	TU	Yes
299-E25-34	A4782	203.117	Survey	TU	Yes
299-E25-35	A4783	206.636	Survey	TU	Yes
299-E25-36	A4784	216.735	Survey	TU	Yes
299-E25-40	A4789	203.997	Survey	TU	Yes
299-E25-41	A4790	205.688	Survey	TU	Yes
299-E25-42	A4791	209.331	VERTCON	TU	Yes
299-E25-48	A4795	208.982	Survey	TU	Yes
299-E25-93	C4122	208.040	Survey	UU	Yes
299-E26-10	A4799	184.420	Survey	TU	Yes
299-E26-11	A4800	183.880	Survey	UU	Yes
299-E26-12	A4801	193.312	VERTCON	TU	Yes
299-E26-13	A4802	185.473	VERTCON	TU	Yes
299-E26-2	A4803	194.787	Survey	UU	Yes
299-E26-4	A4804	198.576	Survey	TU	Yes
299-E27-10	A4808	191.432	Survey	TU	Yes
299-E27-11	A4809	197.163	Survey	TU	Yes
299-E27-12	A4810	202.548	Survey	TU	Yes
299-E27-14	A4812	201.753	Survey	TU	Yes
299-E27-15	A4813	200.024	Survey	TU	Yes
299-E27-16	A4814	199.862	Survey	TU	Yes
299-E27-17	A4815	194.475	Survey	TU	Yes
299-E27-18	A6674	199.175	Survey	TU	Yes
299-E27-19	A6675	199.398	Survey	TU	Yes
299-E27-21	C4127	205.728	Survey	UU	Yes
299-E27-22	C4124	193.383	Survey	UU	Yes
299-E27-23	C4190	206.563	Survey	UU	Yes
299-E27-4	C4125	205.569	Survey	UU	Yes
299-E27-7	A4816	194.536	Survey	UU	Yes
299-E27-8	A4817	195.503	Survey	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
299-E27-9	A4818	192.874	Survey	TU	Yes
299-E28-1	A6784	209.850	Survey	UU	Yes
299-E28-14	A6792	212.764	Survey	LU	No
299-E28-17	A4820	216.697	Survey	TU	Yes
299-E28-18	A4821	212.111	Survey	UU	Yes
299-E28-2	A6785	208.551	Survey	UU	Yes
299-E28-23	A6799	210.170	Survey	UU	Yes
299-E28-24	A6800	210.186	Survey	UU	Yes
299-E28-25	A6801	210.026	Survey	UU	Yes
299-E28-26	A4822	210.573	Survey	TU	Yes
299-E28-27	A4823	208.473	Survey	TU	Yes
299-E28-4	A4825	211.780	Survey	UU	Yes
299-E28-5	A6787	206.198	Survey	UU	Yes
299-E28-6	A4826	214.400	Survey	UU	Yes
299-E28-8	A6788	204.827	VERTCON	UU	Yes
299-E28-9	A4828	214.633	Survey	U	Yes
299-E32-10	A5432	195.453	Survey	TU	Yes
299-E32-4	A4832	210.148	Survey	TU	Yes
299-E32-5	A4833	209.013	Survey	TU	Yes
299-E32-6	A4834	204.447	Survey	TU	Yes
299-E32-8	A4836	197.790	Survey	TU	Yes
299-E32-9	A4837	197.103	Survey	TU	Yes
299-E33-13	A4840	192.549	Survey	TU	Yes
299-E33-14	A4841	190.625	Survey	TU	Yes
299-E33-15	A4842	192.217	Survey	TU	Yes
299-E33-16	A6855	195.703	Survey	UU	Yes
299-E33-17	A4843	193.564	Survey	TU	Yes
299-E33-18	A4844	199.712	Survey	TU	Yes
299-E33-20	A4847	199.156	Survey	TU	Yes
299-E33-21	A4848	204.046	Survey	TU	Yes
299-E33-26	A4850	193.884	Survey	TU	Yes
299-E33-28	A4852	203.535	Survey	TU	Yes
299-E33-30	A4855	203.387	Survey	TU	Yes
299-E33-31	A4856	198.356	Survey	TU	Yes
299-E33-32	A4857	202.183	Survey	TU	Yes
299-E33-33	A4858	196.209	Survey	TU	Yes
299-E33-334	B8810	204.207	Survey	TU	Yes
299-E33-335	B8811	204.262	Survey	TU	Yes
299-E33-337	C3390	202.716	Survey	TU	Yes
299-E33-338	C3391	201.107	Survey	TU	Yes
299-E33-339	C3392	203.027	Survey	TU	Yes
299-E33-34	A4859	194.133	Survey	TU	Yes
299-E33-35	A4860	197.074	Survey	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
299-E33-36	A4861	198.185	Survey	TU	Yes
299-E33-37	A4862	200.124	Survey	TU	Yes
299-E33-38	A4863	193.629	Survey	TU	Yes
299-E33-39	A4864	191.007	Survey	TU	Yes
299-E33-41	A4867	200.636	Survey	TU	Yes
299-E33-42	A4868	200.430	Survey	TU	Yes
299-E33-43	A4869	202.989	Survey	TU	Yes
299-E33-44	B8554	196.773	Survey	TU	Yes
299-E33-47	C4259	198.526	Survey	TU	Yes
299-E33-48	C4260	203.358	Survey	TU	Yes
299-E33-49	C4261	204.003	Survey	TU	Yes
299-E33-7	A4871	192.376	Survey	TU	Yes
299-E33-9	A4873	199.390	Survey	TU	Yes
299-E34-10	A4875	196.016	Survey	TU	Yes
299-E34-12	A5433	195.727	Survey	TU	Yes
299-E34-2	A4877	193.350	Survey	TU	Yes
299-E34-7	A4882	185.264	Survey	TU	Yes
299-E34-8	A4883	196.323	Survey	TU	Yes
299-E34-9	A4884	192.642	Survey	TU	Yes
299-W10-1	A7136	207.459	Survey	U	Yes
299-W10-14	A4891	214.287	Survey	LU	No
299-W10-20	A5439	210.602	Survey	TU	Yes
299-W10-21	A5440	206.490	Survey	TU	Yes
299-W10-22	A9890	208.954	Survey	TU	Yes
299-W10-23	B8545	207.491	Survey	TU	Yes
299-W10-24	B8546	209.725	Survey	TU	Yes
299-W10-26	B8548	205.452	Survey	TU	Yes
299-W10-27	C3125	205.624	Survey	TU	Yes
299-W10-28	C3400	206.826	Survey	TU	Yes
299-W10-29	C4988	212.363	Survey	TU	Yes
299-W10-30	C4989	211.647	Survey	TU	Yes
299-W10-31	C5194	210.384	Survey	TU	Yes
299-W10-4	A7137	205.524	Survey	TU	Yes
299-W10-5	A4898	205.962	Survey	TU	No
299-W10-8	A4899	208.382	Survey	TU	Yes
299-W11-10	A4901	223.187	Survey	TU	Yes
299-W11-12	A4902	208.186	VERTCON	TU	Yes
299-W11-3	A5473	220.019	Survey	U	Yes
299-W11-39	C3117	210.550	Survey	TU	Yes
299-W11-40	C3118	210.428	Survey	TU	Yes
299-W11-41	C3119	210.641	Survey	TU	Yes
299-W11-42	C3242	211.066	Survey	TU	Yes
299-W11-43	C4694	217.521	Survey	LU	No

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
299-W11-47	C4990	210.403	Survey	U	No
299-W11-6	A4909	219.772	Survey	U	Yes
299-W11-7	A4910	217.108	Survey	TU	Yes
299-W11-87	C5407	223.642	Survey	MU	No
299-W12-1	A4912	222.444	Survey	TU	Yes
299-W13-1	C4238	223.540	Survey	MU	No
299-W14-11	C4668	205.092	Survey	UU	No
299-W14-13	B8549	205.105	Survey	TU	Yes
299-W14-14	B8547	205.432	Survey	TU	Yes
299-W14-15	C3114	205.354	Survey	TU	Yes
299-W14-16	C3120	206.123	Survey	TU	Yes
299-W14-17	C3121	205.853	Survey	TU	Yes
299-W14-18	C3396	205.019	Survey	TU	Yes
299-W14-19	C3957	205.612	Survey	TU	Yes
299-W14-5	A5475	204.199	Survey	TU	Yes
299-W14-6	A7331	203.556	Survey	TU	Yes
299-W15-1	A7348	206.993	Survey	U	No
299-W15-11	A5474	208.261	Survey	TU	Yes
299-W15-15	A4919	213.838	Survey	TU	Yes
299-W15-152	C4685	210.158	Survey	TU	Yes
299-W15-16	A4920	209.853	Survey	TU	Yes
299-W15-17	A4921	209.783	Survey	LU	No
299-W15-2	A5466	212.411	Survey	TU	Yes
299-W15-224	C4986	209.190	Survey	TU	Yes
299-W15-30	B2410	210.126	Survey	UU	Yes
299-W15-31A	B2471	208.480	Survey	TU	Yes
299-W15-33	B2643	206.834	Survey	TU	Yes
299-W15-37	B2753	203.028	Survey	TU	Yes
299-W15-38	B2754	203.691	Survey	TU	Yes
299-W15-39	B2755	202.129	Survey	TU	Yes
299-W15-41	B8815	203.484	Survey	TU	Yes
299-W15-42	C3803	207.391	Survey	U	Yes
299-W15-49	C4301	209.127	Survey	UU	Yes
299-W15-50	C4302	203.230	Survey	MU	Yes
299-W15-7	A5476	204.249	Survey	TU	Yes
299-W15-763	C3339	202.947	Survey	TU	Yes
299-W15-83	C4683	209.627	Survey	TU	Yes
299-W15-94	C4684	210.174	Survey	TU	Yes
299-W17-1	C4237	199.174	Survey	TU	Yes
299-W18-1	A5481	209.058	Survey	U	No
299-W18-15	A4932	202.219	Survey	TU	Yes
299-W18-16	C4303	208.580	Survey	TU	Yes
299-W18-21	A4933	204.900	Survey	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
299-W18-22	A4934	204.857	Survey	LU	No
299-W18-28	A4940	208.222	Survey	TU	Yes
299-W18-30	A4942	206.117	Survey	TU	Yes
299-W18-31	A4943	203.474	Survey	TU	Yes
299-W18-33	A5450	204.914	Survey	TU	Yes
299-W18-40	C3395	203.413	Survey	UU	Yes
299-W19-101	C4966	214.201	Survey	UU	Yes
299-W19-105	C4968	213.729	Survey	TU	Yes
299-W19-107	C5193	217.412	Survey	UU	No
299-W19-12	A4945	206.232	Survey	UU	Yes
299-W19-18	A7743	213.983	Survey	TU	Yes
299-W19-34A	A9517	215.331	Survey	MU	No
299-W19-34B	A9513	215.475	Survey	MU	No
299-W19-35	A9515	213.630	Survey	TU	Yes
299-W19-37	B2465	214.581	Survey	TU	Yes
299-W19-41	B8551	206.531	Survey	TU	Yes
299-W19-42	B8553	206.242	Survey	TU	Yes
299-W19-44	C3393	207.277	Survey	TU	Yes
299-W19-45	C3394	206.413	Survey	TU	Yes
299-W19-46	C3958	214.101	Survey	TU	Yes
299-W19-47	C4258	206.276	Survey	TU	Yes
299-W19-48	C4300	212.865	Survey	UU	Yes
299-W19-49	C4695	214.196	Survey	TU	Yes
299-W21-2	C4639	214.850	Survey	TU	Yes
299-W22-20	A7843	207.091	Survey	TU	Yes
299-W22-24P	A9568	212.225	VERTCON	CR	No
299-W22-24Q	A9569	212.219	VERTCON	CR	No
299-W22-24R	A9570	212.225	VERTCON	LU	No
299-W22-24S	A9571	212.219	VERTCON	MU	No
299-W22-24T	A9572	212.219	VERTCON	MU	No
299-W22-26	A4968	208.379	Survey	TU	Yes
299-W22-44	A4975	207.760	VERTCON	TU	Yes
299-W22-45	A4976	204.126	VERTCON	TU	Yes
299-W22-47	C4667	206.275	Survey	UU	Yes
299-W22-48	B8812	207.895	Survey	TU	Yes
299-W22-49	B8813	204.719	Survey	TU	Yes
299-W22-50	B8814	205.012	Survey	TU	Yes
299-W22-69	C4969	207.949	Survey	TU	Yes
299-W22-72	C4970	208.015	Survey	TU	Yes
299-W22-79	B8552	211.735	Survey	TU	Yes
299-W22-80	C3115	200.851	Survey	TU	Yes
299-W22-81	C3123	206.644	Survey	TU	Yes
299-W22-82	C3124	206.872	Survey	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
299-W22-83	C3126	207.015	Survey	TU	Yes
299-W22-84	C3398	208.510	Survey	TU	Yes
299-W22-85	C3399	204.409	Survey	TU	Yes
299-W22-86	C4971	206.410	Survey	TU	Yes
299-W22-87	C4977	212.015	Survey	TU	Yes
299-W22-9	A7834	207.515	Survey	U	No
299-W23-10	A7884	203.790	Survey	TU	Yes
299-W23-15	A4984	200.843	VERTCON	TU	Yes
299-W23-20	C3112	203.795	Survey	TU	Yes
299-W23-21	C3113	203.352	Survey	TU	Yes
299-W26-13	B8817	199.815	Survey	TU	Yes
299-W26-14	B8828	205.430	Survey	TU	Yes
299-W27-2	A5410	207.404	Survey	LU	No
299-W6-11	A5436	215.248	Survey	UU	Yes
299-W6-12	A5437	212.091	Survey	TU	Yes
299-W6-3	A4998	214.373	VERTCON	LU	No
299-W6-6	A5001	217.470	VERTCON	LU	No
299-W7-3	A5009	207.185	Survey	LU	No
299-W7-4	A5010	205.833	Survey	TU	Yes
299-W7-7	A5013	206.818	Survey	TU	Yes
299-W8-1	A5016	214.862	Survey	TU	Yes
3099-42-16	A9385	125.411	Survey	U	Yes
3099-47-18B	A5062	116.298	Estimate	U	Yes
399-1-1	A5018	115.836	Survey	TU	Yes
399-1-10A	A5411	114.894	Survey	TU	Yes
399-1-11	A5020	116.159	Survey	TU	Yes
399-1-12	A5021	118.199	Survey	UU	Yes
399-1-13A	A5412	119.466	Survey	TU	Yes
399-1-14A	A5413	117.823	Survey	TU	Yes
399-1-15	A5024	116.711	Survey	TU	Yes
399-1-16A	A5025	117.303	Survey	TU	Yes
399-1-16B	A5026	117.185	Survey	LU	No
399-1-17A	A5028	116.073	Survey	TU	Yes
399-1-17B	A5029	116.185	Survey	MU	No
399-1-17C	A5030	116.263	Survey	CR	No
399-1-18A	A5031	120.140	Survey	TU	Yes
399-1-18B	A5032	119.871	Survey	MU	No
399-1-18C	A5033	119.295	Survey	LU	No
399-1-23	C5000	116.307	Survey	TU	Yes
399-1-3	A5036	118.290	Survey	TU	No
399-1-4	A5037	117.033	Survey	TU	Yes
399-1-6	A5039	114.958	Survey	TU	Yes
399-1-7	A5040	118.561	Survey	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
399-1-8	A5041	118.342	Survey	LU	No
399-1-9	A5042	118.307	Survey	CR	No
399-2-1	A5043	115.402	Survey	TU	Yes
399-2-2	A5044	116.098	Survey	TU	Yes
399-2-3	A5045	115.458	Survey	TU	Yes
399-3-1	A5046	118.194	Survey	TU	Yes
399-3-10	A5047	118.487	Survey	TU	Yes
399-3-11	A8077	121.470	Survey	TU	Yes
399-3-12	A5048	119.307	Survey	TU	Yes
399-3-18	C4999	118.615	Survey	TU	Yes
399-3-19	C5001	121.447	Survey	TU	Yes
399-3-20	C5002	121.276	Survey	TU	Yes
399-3-21	C5575	121.158	Survey	LU	No
399-3-6	A5049	120.757	Survey	TU	Yes
399-3-9	A5051	119.319	Survey	TU	Yes
399-4-1	A5052	121.611	Survey	TU	Yes
399-4-10	A5053	116.410	Survey	TU	Yes
399-4-11	A5054	124.306	Survey	TU	Yes
399-4-7	A5055	116.416	Survey	TU	Yes
399-4-9	A5056	117.515	Survey	TU	Yes
399-5-1	A5057	121.588	Survey	TU	Yes
399-5-4B	A8094	121.321	Survey	TU	Yes
399-6-1	A5058	119.534	Survey	TU	Yes
399-8-1	A5059	121.772	Survey	TU	Yes
399-8-2	A5060	122.348	Survey	TU	Yes
399-8-3	A5061	121.351	Survey	TU	Yes
399-8-4	A8096	121.107	Survey	TU	Yes
399-8-5A	A5416	123.028	Survey	TU	Yes
399-8-5B	A5417	122.889	Survey	LU	No
399-8-5C	A5418	122.908	Survey	CR	No
699-101-48B	A5066	119.934	Survey	UU	Yes
699-10-54A	A5063	158.409	Survey	UU	Yes
699-10-E12	A5065	132.347	Survey	TU	No
699-10-E12P	A9579	132.351	Survey	CR	No
699-10-E12Q	A9580	132.348	Survey	UU	Yes
699-11-45A	A5067	177.331	Survey	U	Yes
699-1-18	A8120	164.889	Survey	TU	Yes
699-12-2C	C3253	136.177	Survey	TU	Yes
699-12-4D	A8252	136.782	Survey	TU	Yes
699-13-0A	C3256	126.953	Survey	TU	Yes
699-13-1A	A8260	135.619	Survey	U	No
699-13-1B	A8261	134.682	Survey	U	No
699-13-1E	C3798	136.198	Survey	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
699-13-2D	C3254	136.713	Survey	TU	Yes
699-13-3A	B2540	136.420	Survey	TU	Yes
699-13-64	A8272	169.271	Survey	TU	Yes
699-14-38	A5068	157.967	Survey	UU	No
699-14-38P	A9583	157.970	Survey	CR	No
699-14-38Q	A9584	157.969	Survey	LU	No
699-14-47	A5069	180.016	Survey	TU	Yes
699-14-E6S	A8314	140.587	Survey	LU	No
699-15-15A	A5071	167.768	Survey	TU	Yes
699-15-15B	A8318	168.141	Survey	TU	No
699-15-26	A5072	160.664	Survey	TU	Yes
699-17-5	A5073	132.997	Survey	TU	Yes
699-17-70	A5074	172.664	Survey	TU	Yes
699-19-43	A5075	169.134	Survey	UU	Yes
699-19-58	A5076	175.662	Survey	TU	Yes
699-19-88	A5077	197.405	Survey	TU	Yes
699-20-20	A5080	155.106	Survey	TU	Yes
699-20-39	A5081	165.580	Survey	TU	Yes
699-20-39P	A9608	165.586	Survey	CR	No
699-20-E12	A5085	134.364	Survey	TU	Yes
699-20-E12P	A9614	134.388	VERTCON	CR	No
699-20-E12Q	A9615	134.388	VERTCON	LU	No
699-20-E12R	A9616	134.388	VERTCON	MU	No
699-20-E12S	A9617	134.388	VERTCON	MU	No
699-20-E5A	A8428	143.673	Survey	TU	Yes
699-20-E5T	A8433	143.602	VERTCON	UU	No
699-21-17	A5086	162.473	Survey	U	Yes
699-21-6	A8438	134.083	Survey	TU	Yes
699-22-35	A8443	163.811	VERTCON	TU	Yes
699-2-3	A5078	146.366	Survey	TU	Yes
699-23-34A	A5087	163.418	Survey	TU	Yes
699-2-33A	A5079	164.491	Survey	TU	Yes
699-2-33BP	A9478	164.425	VERTCON	CR	No
699-2-33BQ	A9479	164.425	VERTCON	MU	No
699-24-1Q	A8454	145.894	Survey	CR	No
699-24-1R	A8455	146.598	Survey	CR	No
699-24-1S	A8456	146.192	Survey	MU	No
699-24-34B	A5091	163.614	Survey	TU	Yes
699-24-35	A5093	165.234	Survey	TU	Yes
699-24-46	A8457	181.200	Survey	TU	Yes
699-25-34C	A5097	164.218	Survey	TU	Yes
699-25-55	A5098	207.272	Survey	TU	Yes
699-25-70	A5099	192.966	Survey	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
699-26-15A	A5100	136.074	Survey	TU	Yes
699-26-33	A5101	164.308	Survey	TU	Yes
699-26-34A	A5102	162.061	Survey	TU	Yes
699-26-34B	A5420	162.632	Survey	TU	Yes
699-26-35A	A5103	163.360	Survey	TU	Yes
699-26-89	A5108	199.716	Survey	UU	Yes
699-2-7	A8122	157.119	Survey	U	Yes
699-27-8	A5109	142.922	Survey	TU	Yes
699-28-40	A5110	171.545	Survey	TU	Yes
699-28-40P	A9628	171.615	Survey	CR	No
699-28-40Q	A9629	171.612	Survey	MU	No
699-28-52A	A5111	209.640	Survey	TU	Yes
699-29-4	A8490	149.941	Survey	TU	Yes
699-29-70AQ	A5113	193.078	Survey	CR	No
699-29-78	A5121	198.246	Survey	LU	No
699-30-66	C4298	210.481	Survey	LU	No
699-31-31	A5123	162.365	Survey	TU	Yes
699-31-31P	A9633	162.395	VERTCON	LU	No
699-31-31Q	A9634	162.395	VERTCON	MU	No
699-32-22A	A5126	158.774	Survey	TU	Yes
699-32-43	A5127	158.504	Survey	TU	Yes
699-32-62	A5128	216.562	Survey	TU	Yes
699-32-72B	A9525	205.119	VERTCON	TU	Yes
699-32-77	A5131	200.341	Survey	TU	Yes
699-33-42	A5132	158.307	Survey	TU	Yes
699-33-56	A5133	219.567	Survey	TU	Yes
699-34-39A	A5134	164.720	Survey	TU	Yes
699-34-41B	A5135	175.031	Survey	TU	Yes
699-3-45	A5122	154.785	Survey	TU	Yes
699-34-51	A5137	225.538	Survey	UU	Yes
699-34-88	A5138	194.039	Survey	TU	Yes
699-35-66A	A5139	222.452	Survey	TU	Yes
699-35-70	A5140	212.326	Survey	TU	Yes
699-35-78A	A5141	202.383	Survey	TU	Yes
699-35-9	A5142	153.363	Survey	TU	Yes
699-36-27	A8566	163.311	VERTCON	U	No
699-36-61A	A5144	229.031	Survey	TU	Yes
699-36-70A	A9901	216.047	Survey	TU	Yes
699-36-70B	C4299	215.240	Survey	TU	Yes
699-36-93	A5145	197.525	Survey	U	Yes
699-37-43	A5146	211.358	Survey	TU	Yes
699-37-47A	B2822	219.495	Survey	TU	Yes
699-38-15	A8594	139.650	Survey	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
699-38-65	A5148	230.709	Survey	TU	Yes
699-38-70	A5149	217.704	Survey	TU	Yes
699-38-70B	C4236	222.559	Survey	MU	No
699-38-70C	C4256	226.670	Survey	LU	No
699-39-0	A8600	137.998	Survey	TU	Yes
699-39-79	A5151	206.450	Survey	TU	Yes
699-40-1	A5152	134.706	Survey	TU	Yes
699-40-12C	A8629	158.313	Survey	U	Yes
699-40-33A	A5153	158.923	Survey	UU	No
699-40-36	A5154	162.244	Survey	MU	No
699-40-40A	A5156	165.987	Survey	MU	No
699-40-62	A5158	228.930	Survey	TU	Yes
699-40-65	C4235	231.028	Survey	TU	Yes
699-41-23	A5159	143.397	Survey	TU	Yes
699-41-25	A8652	144.172	Survey	U	Yes
699-41-35	A5160	159.641	Survey	MU	No
699-41-40	A5161	167.384	Survey	MU	No
699-41-42	A5162	197.294	Survey	MU	No
699-42-12A	A5163	157.780	Survey	TU	Yes
699-42-2	A8660	133.125	Survey	TU	Yes
699-42-37	A5164	159.343	Survey	MU	No
699-42-39B	A5166	171.200	Survey	LU	No
699-42-40A	A5167	167.158	Survey	UU	No
699-42-40B	A5168	167.439	Survey	UU	No
699-42-42A	A8670	184.541	Survey	U	No
699-42-42B	A5171	178.749	Survey	MU	No
699-43-104	A5172	234.814	Survey	TU	Yes
699-43-41E	A5174	168.885	Survey	MU	No
699-43-41G	A5176	169.076	Survey	CR	No
699-43-44	B8758	177.370	Survey	TU	Yes
699-43-45	A5180	183.150	Survey	TU	Yes
699-43-89	A5181	197.720	Survey	U	Yes
699-43-9	A8679	150.978	Survey	U	No
699-43-91A	A8700	205.499	Survey	NA	No
699-43-91AQ	A5183	205.873	VERTCON	CR	No
699-44-16	A8705	137.457	VERTCON	U	Yes
699-44-39B	A5185	157.512	Survey	UU	No
699-44-64	A5188	222.193	Survey	TU	Yes
699-45-42	A5195	177.057	Survey	CR	No
699-46-21B	A5197	160.183	Survey	TU	Yes
699-47-35A	A5198	146.214	Survey	UU	No
699-47-35B	A5199	146.303	Survey	CR	No
699-47-60	A5202	199.578	Survey	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
699-47-80AQ	A5204	218.542	VERTCON	LU	No
699-48-18	A8764	130.389	Survey	TU	Yes
699-48-50	A5212	175.994	Survey	TU	Yes
699-48-50B	C5196	186.303	Survey	TB	Yes
699-48-71	A5214	210.864	Survey	TU	Yes
699-48-77A	A8772	206.674	Survey	TU	Yes
699-48-77C	A8774	206.585	VERTCON	MU	No
699-48-77D	A8775	206.460	VERTCON	TU	Yes
699-48-96	A8776	246.065	Survey	U	No
699-49-13E	A5215	126.832	Survey	UU	Yes
699-49-55A	A5217	162.864	Survey	TU	Yes
699-49-57A	A5219	169.721	Survey	TU	Yes
699-49-79	A5221	211.077	Survey	TU	Yes
699-50-28B	A5222	164.795	Survey	UU	Yes
699-50-30	A5223	162.218	Survey	TU	Yes
699-50-42	A5224	143.344	Survey	CR	No
699-50-56	C5197	168.896	Survey	TU	Yes
699-50-59	C4882	173.360	Survey	TU	Yes
699-50-74	C4697	201.402	Survey	TU	Yes
699-50-85	A5229	226.375	Survey	UU	Yes
699-51-19	A8823	131.027	Survey	U	No
699-51-63	A5231	175.302	Survey	TU	Yes
699-51-75	A5232	196.561	Survey	TU	Yes
699-51-75P	A9730	196.558	Survey	LU	No
699-52-19	A5233	126.308	Survey	TU	Yes
699-53-35	A5238	162.881	Survey	UU	No
699-53-47A	A5239	134.628	Survey	TU	Yes
699-53-47B	A5240	134.731	Survey	TU	Yes
699-53-48A	A5241	135.903	Survey	TU	No
699-53-55A	A5244	176.739	Survey	U	No
699-53-55B	A5245	176.827	Survey	LU	No
699-53-55C	A5246	176.610	Survey	UU	No
699-54-18B	A8856	124.016	VERTCON	U	Yes
699-54-37A	A5249	163.808	Survey	TB	No
699-54-42	A5250	156.952	Survey	TU	No
699-54-45A	A5251	151.700	Survey	TU	Yes
699-54-48	A5252	140.347	Survey	TU	No
699-54-49	A8863	135.058	Survey	TU	Yes
699-55-44	A5256	159.454	Survey	UU	No
699-55-50C	A5257	136.511	Survey	TU	Yes
699-55-55	A5258	172.868	Survey	TU	Yes
699-55-57	A5259	174.197	Survey	TU	Yes
699-55-60A	A8868	175.677	VERTCON	UU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
699-55-70	A5260	174.435	Survey	TU	Yes
699-55-70P	A9740	174.434	Survey	LU	No
699-55-76	A5261	178.727	Survey	UU	Yes
699-55-89	A5262	185.289	Survey	UU	Yes
699-55-95	A5263	238.092	Survey	UU	No
699-55-95P	A9487	238.002	VERTCON	MU	No
699-55-95Q	A9488	238.002	VERTCON	LU	No
699-57-29A	A5267	127.660	Survey	TU	Yes
699-57-59	A5269	176.650	Survey	TU	Yes
699-57-83A	A5270	177.174	Survey	UU	Yes
699-58-24	A5275	128.662	Survey	TU	Yes
699-59-32	A5276	130.342	Survey	UU	Yes
699-59-55	A8918	132.660	Survey	U	No
699-59-58	A5277	152.803	Survey	TU	Yes
699-59-80B	A5278	178.800	Survey	TU	Yes
699-60-32	A5279	130.646	Survey	UU	Yes
699-60-57	A5280	144.129	Survey	U	Yes
699-60-60	A5282	157.075	Survey	TU	Yes
699-61-37	A5283	136.062	Survey	TU	Yes
699-61-41	A5284	131.793	Survey	TU	Yes
699-61-62	A5285	152.661	Survey	TU	Yes
699-61-66	A5286	160.194	Survey	TU	Yes
699-62-31	A5287	133.336	Survey	UU	Yes
699-62-43A	A5288	132.811	Survey	UU	No
699-63-25A	A5289	121.472	Survey	U	No
699-63-55	A5291	131.010	Survey	TU	Yes
699-63-58	A5292	150.919	Survey	TU	Yes
699-63-90	A5293	156.855	Survey	TU	Yes
699-64-27	A5295	127.284	Survey	TU	Yes
699-64-62	A5296	153.473	Survey	TU	Yes
699-65-22	A5297	120.212	Survey	U	Yes
699-65-50	A5300	143.365	Survey	TU	Yes
699-65-59A	A5301	155.537	Survey	TU	Yes
699-65-72	A5302	165.676	Survey	TU	Yes
699-65-83	A5303	149.047	Survey	TU	Yes
699-66-103	A5305	142.346	Survey	TU	Yes
699-66-23	A5306	119.593	Survey	TU	No
699-66-38	A5307	133.975	Survey	TU	Yes
699-66-39	A5308	139.325	Survey	TU	Yes
699-66-58	A5309	154.402	Survey	TU	Yes
699-66-64	A5310	155.194	Survey	TU	Yes
699-67-51	A5312	160.884	Survey	TU	Yes
699-67-51P	A9753	160.885	Survey	MU	No

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
699-67-51Q	A9754	160.886	Survey	LU	No
699-67-86	A5313	145.016	Survey	TU	Yes
699-68-105	A5315	139.450	Survey	TU	Yes
699-69-38	A5316	130.103	Survey	U	Yes
699-69-45	A8967	149.432	Survey	UU	No
699-69-45O	A5317	149.479	Survey	TU	Yes
699-69-45P	A9759	149.491	Survey	LU	No
699-69-45Q	A9760	149.491	Survey	LU	No
699-69-45R	A9761	149.490	Survey	MU	No
699-70-23	A5318	120.384	Survey	U	Yes
699-70-68	A5319	161.380	Survey	TU	Yes
699-71-30	A5320	123.132	Survey	UU	No
699-71-52	A5321	160.427	Survey	TU	No
699-71-77	A5322	144.961	Survey	TU	Yes
699-72-73	A5323	148.125	Survey	TU	Yes
699-72-92	A5325	138.054	Survey	TU	Yes
699-73-61	A5327	163.014	Survey	TU	Yes
699-74-44	A5328	136.703	Survey	TU	Yes
699-77-36	A5330	126.669	Survey	TU	Yes
699-77-54	A5331	147.346	Survey	TU	Yes
699-78-62	A5332	144.195	Survey	TU	Yes
699-80-43P	A8993	127.137	Survey	CR	No
699-80-43S	A5336	126.820	Survey	UU	Yes
699-81-38	A5337	124.887	Survey	U	Yes
699-81-58	A5338	134.988	Survey	TU	Yes
699-8-17	A5333	160.271	Survey	TU	Yes
699-8-25	A5334	156.245	Survey	TU	Yes
699-8-32	A5335	170.007	Survey	TU	Yes
699-83-47	A5341	133.704	Survey	TU	Yes
699-84-35AO	A9769	123.025	Survey	TU	No
699-84-35AP	A9770	123.026	Survey	MU	No
699-84-35AQ	A9771	123.027	Survey	LU	No
699-84-35AR	A9772	123.028	Survey	MU	No
699-84-35AS	A9773	123.026	Survey	UU	No
699-86-42	A5344	125.944	Survey	U	Yes
699-87-42A	A5345	127.969	Survey	U	Yes
699-87-55	A5346	141.122	Survey	TU	Yes
699-88-41	A5347	127.822	Survey	U	Yes
699-89-35	A5348	122.350	Survey	TU	Yes
699-90-34	A5350	120.612	Survey	TU	Yes
699-90-37B	A5353	129.910	Survey	TU	Yes
699-90-45	A5352	129.511	Survey	TU	Yes
699-91-46A	A5354	128.130	Survey	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
699-92-49	A5355	132.662	Survey	TU	Yes
699-93-48A	A5356	134.446	Survey	TU	Yes
699-96-43	A5357	129.592	Survey	TU	Yes
699-96-44	C4131	129.986	Survey	TU	Yes
699-96-45	C4132	129.947	Survey	TU	Yes
699-96-49	A5358	128.805	Survey	TU	No
699-96-49P	A9775	128.808	Survey	UU	No
699-97-43	A5360	129.597	Survey	TU	Yes
699-97-51A	A5362	123.637	Survey	TU	Yes
699-98-49A	A5363	123.485	Survey	TU	Yes
699-99-42	A5364	126.870	Survey	TU	Yes
699-9-E2	A5349	128.505	Survey	TU	Yes
699-S11-E12A	A9181	112.511	Survey	U	Yes
699-S12-29	A5365	149.661	Survey	TU	Yes
699-S12-29P	A9780	149.661	Survey	CR	No
699-S12-29Q	A9781	149.660	Survey	LU	No
699-S12-3	A5366	133.731	Survey	TU	Yes
699-S14-20A	A5367	151.275	Survey	UU	Yes
699-S18-E2A	A5368	133.559	Survey	MU	No
699-S18-E2AP	A9785	133.666	VERTCON	TB	No
699-S18-E2B	A9199	133.376	Survey	TU	No
699-S19-11	A5369	148.494	Survey	TU	Yes
699-S19-E13	A5370	121.261	Survey	TU	Yes
699-S19-E14	A5421	114.974	Survey	TU	Yes
699-S20-E10	C4855	120.480	Survey	TU	Yes
699-S22-E9A	A5422	115.066	Survey	TU	Yes
699-S22-E9B	A5423	114.914	Survey	LU	No
699-S22-E9C	A5424	114.477	Survey	CR	No
699-S24-19Q	B2782	130.324	Survey	TU	Yes
699-S27-E12A	B2420	119.585	Survey	TU	Yes
699-S27-E14	A5371	123.479	Survey	TU	Yes
699-S27-E9A	A5425	119.966	Survey	TU	Yes
699-S27-E9B	A5426	120.015	Survey	LU	No
699-S27-E9C	A5427	120.057	Survey	CR	No
699-S28-E12	A5428	119.813	Survey	TU	Yes
699-S28-E13A	B2419	119.795	Survey	TU	Yes
699-S29-E10A	B2422	120.156	Survey	TU	Yes
699-S29-E11	A9207	118.563	Survey	TU	Yes
699-S29-E12	A5372	119.260	Survey	UU	Yes
699-S29-E13A	B2418	119.915	Survey	TU	Yes
699-S29-E16A	A5429	116.756	Survey	TU	Yes
699-S29-E16B	A5430	116.801	Survey	MU	No
699-S29-E16C	A5431	116.679	Survey	CR	No

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
699-S30-E10A	A5375	120.582	Survey	TU	Yes
699-S30-E11A	B2421	119.930	Survey	TU	Yes
699-S30-E15A	A5377	123.155	Survey	TU	Yes
699-S31-1	A5378	141.238	Survey	UU	Yes
699-S31-1P	A9786	141.282	VERTCON	TB	No
699-S31-E10B	A5380	117.968	Survey	TU	Yes
699-S31-E10C	A5381	117.722	Survey	UU	No
699-S31-E10E	A9216	117.873	Survey	MU	No
699-S31-E11	A9220	119.118	Survey	TU	Yes
699-S31-E8A	A5384	115.246	Survey	TU	Yes
699-S3-25	A5373	160.611	Survey	UU	Yes
699-S32-E11	A9223	118.933	Survey	TU	Yes
699-S32-E13A	A5385	120.023	Survey	UU	Yes
699-S32-E13B	A5386	121.322	Survey	UU	Yes
699-S32-E8	A5387	115.472	Survey	MU	No
699-S33-2A	B8102	143.192	VERTCON	UU	Yes
699-S34-2A	B8103	146.712	VERTCON	UU	Yes
699-S34-2B	B8104	141.006	VERTCON	UU	Yes
699-S34-4A	B8105	149.233	VERTCON	UU	Yes
699-S34-E10	A5388	117.548	Survey	TU	Yes
699-S34-E15	A5389	123.911	Survey	TU	Yes
699-S36-E12B	A5391	122.656	Survey	MU	Yes
699-S36-E13A	A5392	122.724	Survey	UU	Yes
699-S36-E13B	A9226	122.822	Survey	MU	No
699-S37-E11A	A5393	122.726	Survey	TU	Yes
699-S37-E12A	A9232	123.893	Survey	TU	Yes
699-S37-E14	A5394	125.461	Survey	TU	Yes
699-S38-E11	A5395	122.511	Survey	TU	Yes
699-S38-E12A	A5396	124.442	Survey	TU	Yes
699-S38-E12B	A5397	124.458	Survey	MU	No
699-S3-E12	A5374	122.302	Survey	TU	Yes
699-S40-E13A	A9238	125.690	Survey	TU	Yes
699-S40-E14	A5398	123.808	Survey	TU	Yes
699-S41-E11A	A5399	123.354	Survey	TU	Yes
699-S41-E12	A5400	123.529	Survey	TU	Yes
699-S41-E13A	A5401	126.155	Survey	TU	Yes
699-S41-E13B	A5402	126.013	Survey	MU	No
699-S41-E13C	A5403	126.187	Survey	LU	No
699-S42-E8A	A9998	110.696	VERTCON	TU	No
699-S42-E8B	A9999	110.422	VERTCON	TU	No
699-S43-E12	A5404	124.644	Survey	TU	Yes
699-S43-E7A	A9997	111.546	VERTCON	TU	Yes
699-S6-E14A	A5405	116.321	Survey	TU	Yes

Table A-2. Wells in the Supra Basalt Aquifer System Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (21 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Relative Monitoring Zone	Used for Water Table Map?
699-S6-E4D	A5406	132.210	Survey	TU	No
699-S6-E4K	C4072	134.945	Survey	TU	Yes
699-S7-34	A5407	161.638	Survey	MU	No
699-S8-19	A5408	154.620	Survey	TU	Yes

C = undifferentiated basalt-confined
CR = confined Ringold
MU = middle unconfined
LU = lower unconfined
ID = identification
LC = lower basalt-confined
NAVD88 = North American Vertical Datum of 1988
TB = top of basalt
TU = top of unconfined
U = undifferentiated unconfined
UC = upper basalt-confined
UU = upper unconfined

Table A-3. Wells in the Upper Basalt-Confined Aquifer System Used for Water-Level Monitoring by the Groundwater Project During Fiscal Year 2008. (2 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Hydrogeologic Unit(s) Monitored
199-H4-2	A5686	129.426	VERTCON	Rattlesnake Ridge interbed
299-E16-1	A4727	212.866	Survey	Elephant Mountain interflow zone
299-E26-8	A4805	189.823	Survey	Rattlesnake Ridge interbed
299-E33-12	A4839	191.046	Survey	Rattlesnake Ridge interbed
299-E33-50	C5195	191.480	Survey	Rattlesnake Ridge interbed
399-5-2	A8091	120.437	Survey	Levey interbed and Elephant Mountain interflow zone
699-13-1C	A8262	135.272	Survey	Elephant Mountain interflow zone and Rattlesnake Ridge interbed
699-22-70P	A9480	188.469	Survey	Upper Saddle Mountains Basalt
699-22-70Q	A9481	188.469	Survey	Rattlesnake Ridge interbed and Pomona basalt
699-24-1P	A8453	145.668	Survey	Rattlesnake Ridge interbed and Pomona basalt
699-26-15C	A8468	135.878	Survey	Upper Saddle Mountains Basalt
699-29-70AP	A5112	192.973	Survey	Rattlesnake Ridge interbed
699-32-22B	A8512	158.578	Survey	Rattlesnake Ridge interbed
699-42-40C	A5169	167.348	Survey	Rattlesnake Ridge interbed
699-43-91AP	A5182	205.742	VERTCON	Rattlesnake Ridge interbed
699-46-32	A8736	144.932	Survey	Rattlesnake Ridge interbed
699-47-50	A5201	179.093	Survey	Rattlesnake Ridge interbed
699-47-80AP	A5203	218.396	VERTCON	Rattlesnake Ridge interbed
699-49-32B	A8792	158.396	Survey	Rattlesnake Ridge interbed
699-49-55B	A5218	162.892	Survey	Rattlesnake Ridge interbed
699-49-57B	A5220	170.473	Survey	Rattlesnake Ridge interbed
699-50-42P	A9486	143.346	Survey	Upper Saddle Mountains Basalt
699-50-45	A5225	138.625	Survey	Rattlesnake Ridge interbed
699-50-48B	A5226	168.778	Survey	Rattlesnake Ridge interbed
699-50-53B	A5228	170.976	Survey	Rattlesnake Ridge interbed
699-51-36B	A8825	159.122	Survey	Upper Saddle Mountains Basalt
699-51-46	A5230	136.554	Survey	Rattlesnake Ridge interbed
699-52-46A	A5234	139.896	Survey	Rattlesnake Ridge interbed
699-52-48	A5235	143.083	Survey	Rattlesnake Ridge interbed
699-53-50	A5243	136.443	Survey	Rattlesnake Ridge interbed
699-54-34	A5248	168.752	Survey	Upper Saddle Mountains Basalt
699-54-45B	A8862	151.287	Survey	Rattlesnake Ridge interbed
699-54-57	A5253	176.644	Survey	Rattlesnake Ridge interbed

Table A-3. Wells in the Upper Basalt-Confined Aquifer System Used for Water-Level Monitoring by the Groundwater Project During Fiscal Year 2008. (2 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Hydrogeologic Unit(s) Monitored
699-56-43	A5264	165.773	Survey	Upper Saddle Mountains Basalt
699-56-53	A5265	133.411	Survey	Rattlesnake Ridge interbed
699-63-92	A5294	152.630	Survey	(unknown)
699-66-91	A5311	143.566	Survey	(unknown)
699-S11-E12AP	A9778	112.511	Survey	Levey interbed?
699-S24-19P	B2781	130.321	Survey	Levey interbed
699-S7-34P	A9791	161.638	Survey	(unknown)
699-S7-34Q	A9792	161.638	Survey	(unknown)

ID = identification
NAVD88 = North American Vertical Datum of 1988

Table A-4. Wells in the Lower Basalt-Confined Aquifers Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (2 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Hydrogeologic Unit(s) Monitored
699-17-47	A8370	177.121	Survey	Mabton interbed
699-20-41P	A5082	163.458	Survey	Umtanum flow top
699-20-41Q	A5083	163.458	Survey	Ginko interflow zone
699-20-41R	A5084	163.458	Survey	Priest Rapids interflow zone
699-26-83BP	A5105	194.638	Survey	Umtanum flow top
699-26-83BQ	A5106	194.638	Survey	Rocky Coulee-levering interflow zone
699-26-83BR	A5107	194.638	Survey	Priest Rapids interflow zone
699-29-70CP	A5114	193.279	Survey	Umtanum flow top
699-29-70CQ	A5115	193.331	Survey	Cohassett flow top
699-29-70CR	A5116	193.384	Survey	Rocky Coulee flow top
699-29-70CS	A5117	193.432	Survey	Ginko flow top
699-29-70CT	A5118	193.485	Survey	Sentinel Gap flow top
699-29-70CU	A5119	193.535	Survey	Priest Rapids interflow zone
699-29-70DP	A5120	193.192	Survey	Mabton Interbed
699-2-E14	A8124	119.725	Survey	Open hole from Elephant Mountain basalt to Priest Rapids basalt
699-35-27	A8554	163.097	Survey	Mabton interbed?
699-39-84CP	A9482	195.744	Survey	GR-5 flow interior
699-39-84CQ	A9519	195.691	Survey	GR-5 flow top
699-39-84CR	A9483	195.646	Survey	Cohassett flow interior
699-39-84CS	A9520	195.595	Survey	Cohassett flow top
699-39-84CT	A9521	195.546	Survey	Rocky Coulee flow interior
699-39-84CU	A9522	195.493	Survey	Rocky Coulee flow top
699-43-91DP	B2435	206.070	Survey	Mabton interbed
699-44-91P	A5189	205.937	VERTCON	Umtanum flow top
699-44-91Q	A5190	205.992	VERTCON	Cohassett flow top
699-44-91R	A5191	206.040	VERTCON	Rocky Coulee flow top
699-44-91S	A5192	206.098	VERTCON	Ginko flow top
699-44-91T	A5193	206.147	VERTCON	Sentinel Gap flow top
699-44-91U	A5194	206.199	VERTCON	Priest Rapids interflow zone
699-47-80CP	A5205	218.259	VERTCON	Umtanum flow top
699-47-80CQ	A5206	218.311	VERTCON	Cohassett flow top
699-47-80CR	A5207	218.362	VERTCON	Rocky Coulee flow top
699-47-80CS	A5208	218.417	VERTCON	Ginko flow top
699-47-80CT	A5209	218.463	VERTCON	Sentinel Gap flow top
699-47-80CU	A5210	218.518	VERTCON	Priest Rapids interflow zone
699-47-80DP	A5211	218.405	Survey	Mabton interbed
699-48-48AP	A9719	176.445	VERTCON	GR-20 flow bottom
699-48-48AQ	A9720	175.994	VERTCON	Shear/fault zone within the GR-12 to GR-20 flows
699-48-48AR	A9721	176.088	VERTCON	GR-11 flow bottom

Table A-4. Wells in the Lower Basalt-Confined Aquifers Used for Water-Level Monitoring by the Soil and Groundwater Remediation Project During Fiscal Year 2008. (2 sheets)

Well Name	Well ID	Reference Point Elevation (m NAVD88)	Reference Point Elevation Source	Hydrogeologic Unit(s) Monitored
699-48-48AS	A9722	175.905	VERTCON	McCoy Canyon flow top
699-48-48AT	A9723	175.707	VERTCON	Wanapum Basalt
699-51-36A	A8824	159.375	Survey	Mabton interbed
699-51-36C	A8826	158.980	Survey	(unknown)
699-51-36D	A8827	158.197	Survey	(unknown)
699-52-52	A8842	170.964	Survey	Mabton interbed
699-53-103	A8850	256.181	Survey	Priest Rapids and Roza basalts
699-53-111	A8851	283.363	Survey	(unknown)
699-53-114	A8852	297.704	Survey	(unknown)
699-57-83BP	A5271	177.378	Survey	Ginko interflow zone
699-57-83BQ	A5272	177.431	Survey	Roza flow bottom
699-57-83BR	A5273	177.481	Survey	Priest Rapids interflow zone
699-57-83C	A5274	177.695	Survey	Umtanum flow
699-61-55B	A8934	142.061	Survey	Umatilla basalt, Mabton interbed, and Priest Rapids basalt
699-61-57	A8935	135.617	Survey	Lower Umatilla basalt and upper Mabton interbed
699-63-95	A8958	148.776	Survey	Lolo and Rosalia flows
699-81-62	A9000	135.305	Survey	(unknown)
699-S16-24	A9189	163.235	Survey	Umatilla basalt and Mabton interbed
699-S30-E14	A9209	123.352	Survey	Frenchman Springs basalt

ID = identification
NAVD88 = North American Vertical Datum of 1988

Table A-5. Wells Used for Water-Level Monitoring at Regulated Units During Fiscal Year 2008. (3 sheets)

100-H (183-H Solar Evaporation Basins)							
199-H3-2A	199-H3-2B	199-H3-2C	199-H3-3	199-H3-4	199-H3-5	199-H4-10	199-H4-11
199-H4-12B	199-H4-12C	199-H4-13	199-H4-15B	199-H4-15CP	199-H4-15CQ	199-H4-15CR	199-H4-15CS
199-H4-16	199-H4-2	199-H4-45	199-H4-46	199-H4-47	199-H4-48	199-H4-49	199-H4-5
199-H4-6	199-H4-65	199-H4-8	199-H4-9	199-H5-1A	199-H6-1	699-88-41	699-89-35
699-90-34	699-90-37B	699-90-45	699-91-46A	699-96-43	699-96-44	699-96-45	699-97-43
699-99-42							
100-N (1324-N/NA Facilities and 1301-N and 1325-N Liquid Waste Disposal Facilities)							
199-N-103A	199-N-104A	199-N-105A	199-N-106A	199-N-119	199-N-120	199-N-121	199-N-122
199-N-138	199-N-14	199-N-146	199-N-147	199-N-16	199-N-18	199-N-19	199-N-2
199-N-21	199-N-26	199-N-27	199-N-28	199-N-29	199-N-3	199-N-31	199-N-32
199-N-33	199-N-34	199-N-41	199-N-49	199-N-50	199-N-51	199-N-52	199-N-56
199-N-57	199-N-62	199-N-66	199-N-67	199-N-70	199-N-71	199-N-72	199-N-73
199-N-74	199-N-75	199-N-76	199-N-77	199-N-80	199-N-81	199-N-8P	199-N-8S
199-N-92A	199-N-96A	199-N-99A	699-81-58	699-81-62			
216-A-29 Ditch							
299-E25-26	299-E25-28	299-E25-32P	299-E25-34	299-E25-35	299-E25-48	299-E26-12	299-E26-13
699-43-45							
216-B-3 Pond and Treated Effluent Disposal Facility							
699-40-36	699-40-40A	699-41-35	699-41-40	699-41-42	699-42-37	699-42-39B	699-42-40A
699-42-40B	699-42-40C	699-42-42A	699-42-42B	699-43-41E	699-43-41G	699-43-44	699-43-45
699-44-39B	699-45-42						
216-B-63 Trench							
299-E27-11	299-E27-16	299-E27-17	299-E27-18	299-E27-19	299-E27-8	299-E27-9	299-E33-33
299-E33-36	299-E33-37	299-E34-10	299-E34-8				
216-S-10 Pond and Ditch							
299-W26-13	299-W26-14	299-W27-2	699-32-77				
300 Area (316-5 Process Trenches)							
399-1-1	399-1-10A	399-1-11	399-1-12	399-1-13A	399-1-14A	399-1-15	399-1-16A
399-1-16B	399-1-17A	399-1-17B	399-1-17C	399-1-18A	399-1-18B	399-1-18C	399-1-23
399-1-3	399-1-4	399-1-6	399-1-7	399-1-8	399-1-9	399-2-1	399-2-2
399-2-3	399-3-1	399-3-10	399-3-11	399-3-12	399-3-18	399-3-19	399-3-20
399-3-21	399-3-6	399-3-9	399-4-1	399-4-10	399-4-11	399-4-7	399-4-9
399-5-1	399-5-2	399-5-4B	399-6-1	399-8-1	399-8-2	399-8-3	399-8-4
399-8-5A	399-8-5B	399-8-5C	699-S19-E13	699-S19-E14	699-S20-E10	699-S22-E9A	699-S22-E9B
699-S22-E9C	699-S27-E12A	699-S27-E14	699-S27-E9A	699-S27-E9B	699-S27-E9C	699-S28-E12	699-S28-E13A
699-S29-E13A	699-S29-E16A	699-S29-E16B	699-S29-E16C				
Effluent Treatment Facility State Approved Land Disposal Site							
699-48-77A	699-48-77C	699-48-77D					

Table A-5. Wells Used for Water-Level Monitoring at Regulated Units During Fiscal Year 2008. (3 sheets)

Integrated Disposal Facility and 216-A-10, 216-A-37-1, and 216-A-36B (PUREX) Cribs							
299-E17-18	299-E17-21	299-E17-22	299-E17-23	299-E17-25	299-E17-26	299-E24-16	299-E24-18
299-E24-21	299-E24-24	299-E25-36	699-37-47A				
Liquid Effluent Retention Facility							
299-E26-10	299-E26-11						
LLWMA-1							
299-E28-1	299-E28-17	299-E28-18	299-E28-27	299-E32-5	299-E32-6	299-E32-8	299-E33-28
299-E33-339	299-E33-34	299-E33-38	699-49-55A	699-49-57A	699-50-56		
LLWMA-2							
299-E27-10	299-E27-11	299-E27-17	299-E27-8	299-E27-9	299-E34-10	299-E34-12	299-E34-2
299-E34-7	299-E34-9						
LLWMA-3							
299-W10-14	299-W10-20	299-W10-21	299-W10-29	299-W10-30	299-W10-31	299-W7-3	299-W7-4
299-W7-7	299-W8-1						
LLWMA-4							
299-W15-15	299-W15-152	299-W15-16	299-W15-17	299-W15-224	299-W15-83	299-W15-94	299-W18-21
299-W18-22	299-W18-28						
Solid Waste Landfill/Nonradioactive Dangerous Waste Landfill							
699-22-35	699-23-34A	699-24-34B	699-24-35	699-25-34C	699-26-33	699-26-34A	699-26-34B
699-26-35A							
WMA A-AX SSTs							
299-E24-20	299-E24-22	299-E24-33	299-E25-2	299-E25-40	299-E25-41	299-E25-93	
WMA B-BX-BY SSTs							
299-E28-8	299-E33-15	299-E33-16	299-E33-17	299-E33-18	299-E33-20	299-E33-21	299-E33-26
299-E33-31	299-E33-32	299-E33-334	299-E33-335	299-E33-337	299-E33-338	299-E33-39	299-E33-41
299-E33-42	299-E33-43	299-E33-44	299-E33-47	299-E33-48	299-E33-49	299-E33-7	299-E33-9
WMA C SSTs							
299-E27-12	299-E27-14	299-E27-15	299-E27-21	299-E27-22	299-E27-23	299-E27-4	299-E27-7
WMA S-SX SSTs							
299-W22-26	299-W22-44	299-W22-45	299-W22-47	299-W22-48	299-W22-49	299-W22-50	299-W22-80
299-W22-81	299-W22-82	299-W22-83	299-W22-84	299-W22-85	299-W23-15	299-W23-20	299-W23-21
WMA T SSTs							
299-W10-1	299-W10-20	299-W10-21	299-W10-22	299-W10-23	299-W10-24	299-W10-28	299-W10-4
299-W10-8	299-W11-12	299-W11-39	299-W11-40	299-W11-41	299-W11-42	299-W11-47	

Table A-5. Wells Used for Water-Level Monitoring at Regulated Units During Fiscal Year 2008. (3 sheets)

WMA TX-TY SSTs							
299-W10-26	299-W10-27	299-W14-11	299-W14-13	299-W14-14	299-W14-15	299-W14-16	299-W14-17
299-W14-18	299-W14-19	299-W14-5	299-W14-6	299-W15-41	299-W15-763		
WMA U SSTs							
299-W18-30	299-W18-31	299-W18-33	299-W18-40	299-W19-12	299-W19-41	299-W19-42	299-W19-44
299-W19-45	299-W19-47						

LLWMA = low-level waste management area
PUREX = Plutonium/Uranium Extraction (Facility)
SST = single-shell tank
WMA = waste management area

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